CERAMIC ABSTRACTS and THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

JULY 15, 1943

MONTHLY PUBLICATION DEVOTED TO THE ARTS AND SCIENCES RELATED TO THE SILICATE INDUSTRIES

A ware-burner reads one of a pair of Micromax Indicating Recording Controllers, as he makes entries on a kiln's operation sheet. Below the Controllers are an L&N Temperature Indicator, and its thermocouple-selecting switch box.

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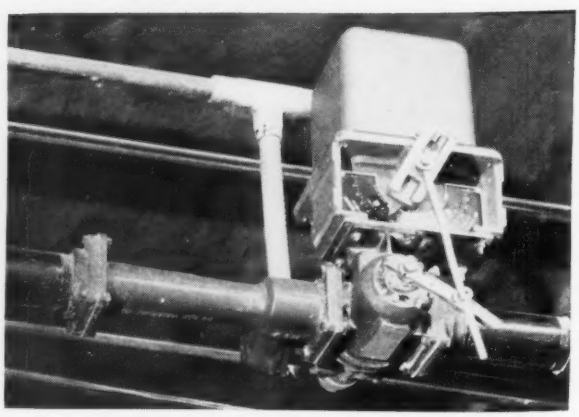

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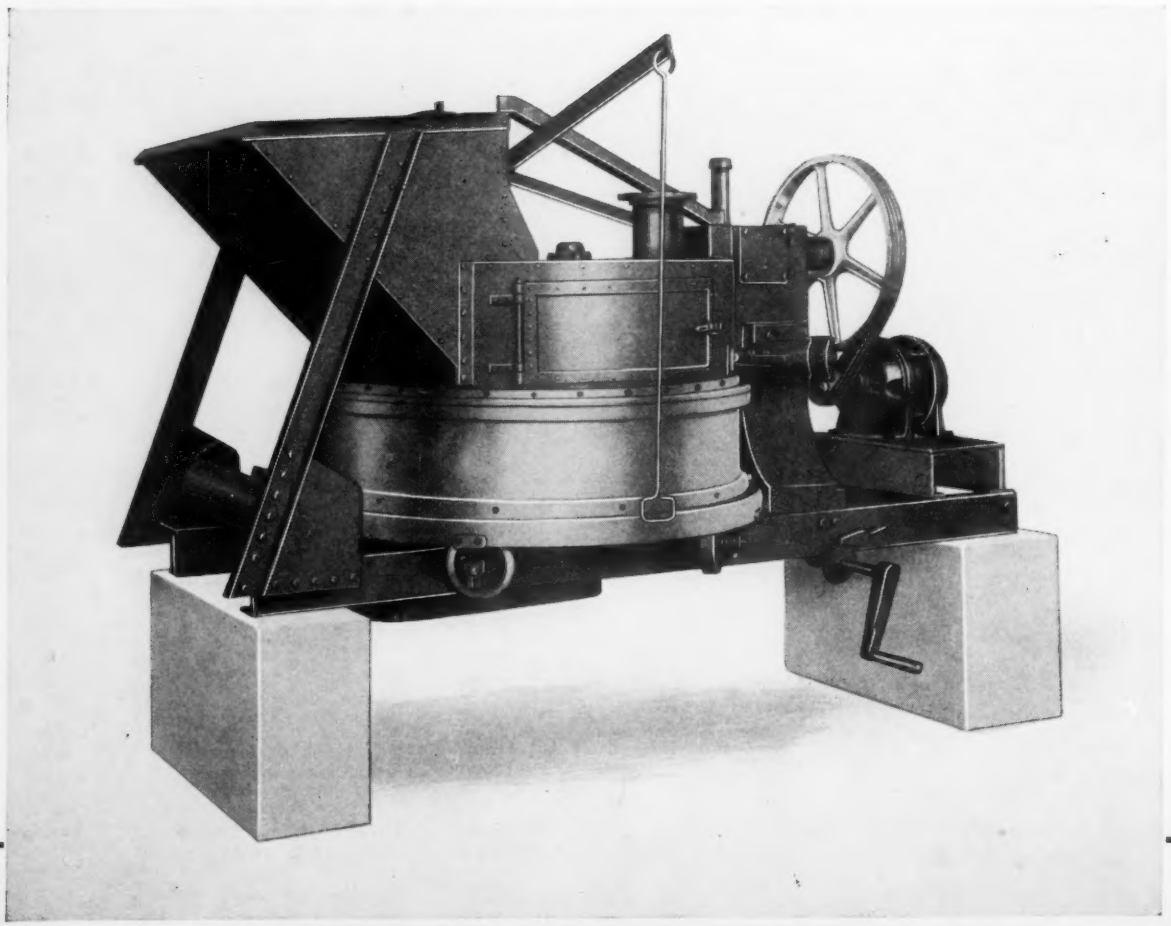

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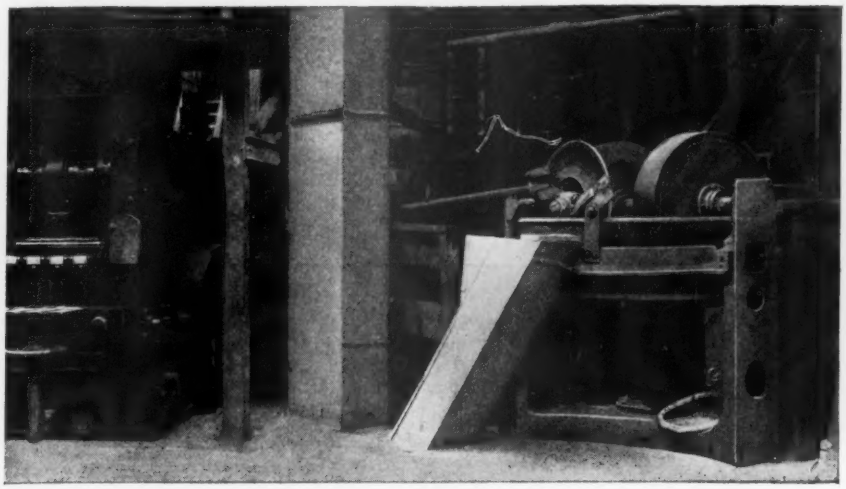

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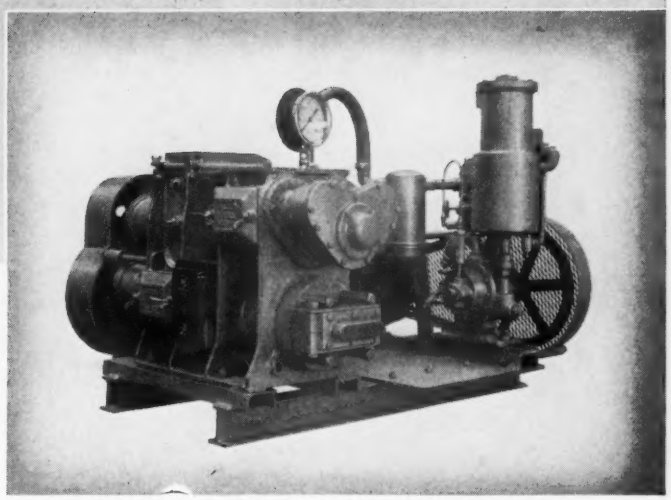

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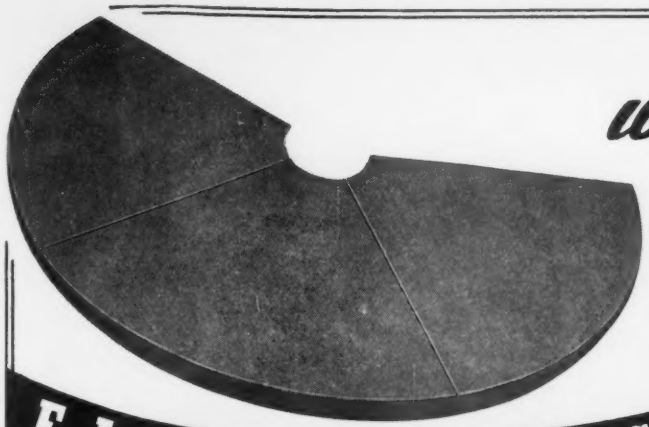

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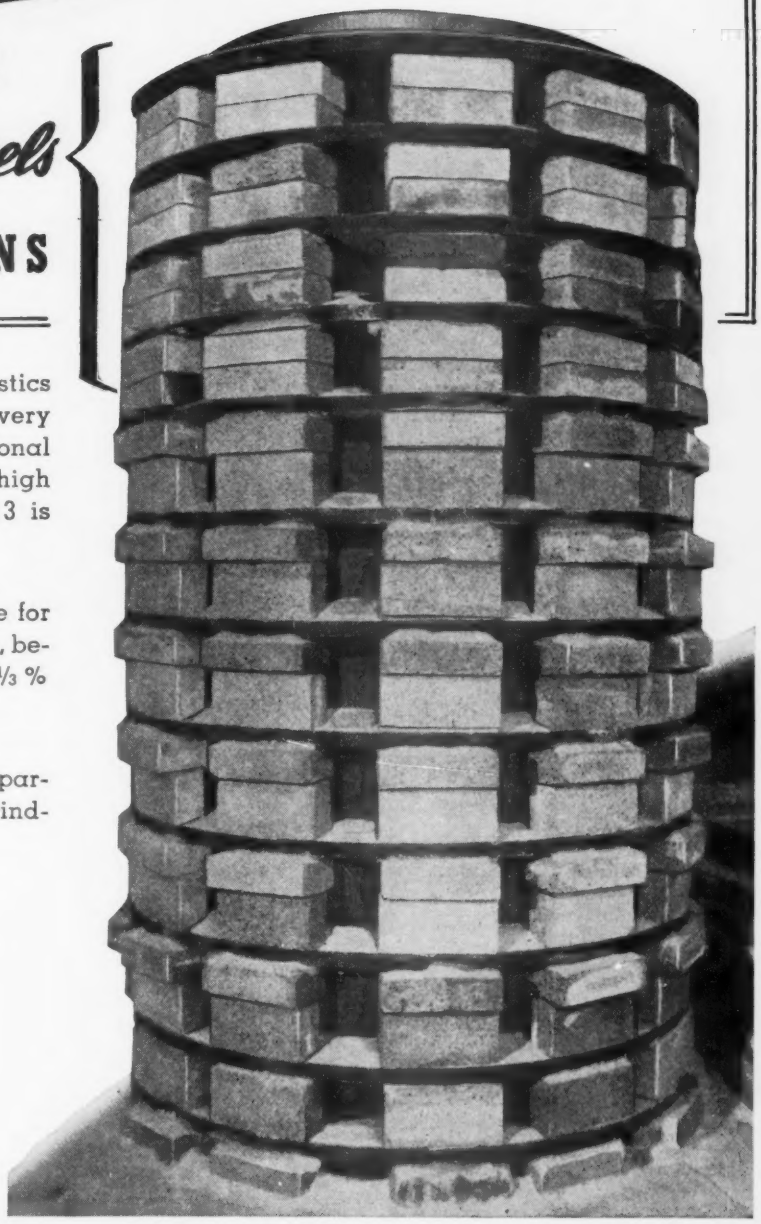

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JOURNAL REFERENCE: The journal name appears in italics, followed by the volume (bold-faced), issue number (in brackets), page numbers, and year (in parentheses).

Vol. 22 July 15, 1943 No. 7

Abrasives

Abrasive industry plays an important part in the war program. ANON. *Ceram. Ind.*, **39** [4] 66–72 (1942).—Manufacturing processes at the Abrasive Co., Philadelphia, are described. Illustrated. H.T.

Buick plant standardizes diamond tools. ANON. *Machinery* [N. Y.], **49** [8] 200–201 (1943).—The Koebel Diamond Tool Co., Detroit, Mich., has developed the Kodi method of standardized diamond tools. The tools have adapters for use in the various grinding machines on the production line. The system of nibs and adapters has already shown great savings in tool costs and machine-tool operation. R.H.B.

Mattison abrasive-belt idler stand and pulley. ANON. *Machinery* [N. Y.], **49** [8] 234 (1943).—Grinding and polishing lathes can be easily adapted to the use of factory-coated abrasive belts by adding the No. J-135 abrasive belt idler stand and pulley recently brought out by the Mattison Machine Works, Rockford, Ill. R.H.B.

New adhesives developed for polishing wheels. ANON. *Machinery* [N. Y.], **49** [8] 213 (1943).—A new adhesive has been developed as a substitute for glue in facing polishing wheels by the Hanson-Van Winkle-Munning Co., Matawan, N. J. R.H.B.

Recent development of bonded diamond wheels. A. A. KLEIN. *Amer. Mineralogist*, **28**, 149–50 (1943).—Metal-bonded diamond wheels are being used in preparing quartz piezoelectric oscillators. They are also used for roughing out precision lenses. Fired ceramic bodies are being precision finished by internal, cylindrical, and thread grinding, grooving, and surfacing with these wheels. Even structural brick is being cut. Synthetic sapphire is also cut by such wheels. A new ceramic vitrified type bond with a high glass content is being developed for diamonds. These wheels have some unique properties. W.D.F.

Securing fine surfaces by grinding: I. H. J. WILLS. *Machinery* [N. Y.], **49** [8] 202–204 (1943).—W. discusses the factors governing fine surface quality and the means by which this quality can be obtained. Critical reference is made to the intangible nomenclature pertaining to the surface finish of metals, such as "commercial," "mirror," "ultra," etc.; an appeal is made for a more scientific basis of surface specification. The recommended terminology for surface roughness according to the American Society of Mechanical Engineers is "root mean square" (r.m.s.). The profilometer gives direct readings in r.m.s. values in micro-inches. The r.m.s. measurement is the average distance from peak to valley of a surface; the values of some profilometers range from one-fourth to one-third the maximum distance from the valley bottom to the top of the peak. Engineering practice leans toward specifying surface finish in micro-inches. A table of roughness figures for automotive parts is given. R.H.B.

Wheel for grinding hard steels. ANON. *Machinery* [N. Y.], **49** [8] 234 (1943).—A precision grinding wheel of open cellular construction has been introduced by the American Emery Wheel Works, Providence, R. I. R.H.B.

PATENTS

Abrasive. LORING COES, JR. (Norton Co.). U. S. 2,319,791, May 25, 1943 (July 23, 1942).—A grinding wheel or other abrasive article comprising abrasive grains bonded together by a bond that comprises the reaction product, under heat-treatment, of a resin-hardening agent comprising a compound selected from the group consisting of the reaction product with chloracetic acid of glycerol $\alpha\gamma$ dichlorhydrin, the reaction product with chloracetic acid of glycerol $\alpha\beta$ dichlorhydrin, and a mixture thereof, which hardening agent is also a grain wettant and wets the abrasive grains initially, and aniline formaldehyde resin.

Abrasive. LORING COES, JR. (Norton Co.). U. S. 2,319,792 to 2,319,794, May 25, 1943 (July 23, 1942).

Abrasive article. JACOB KURTZ (Callite Tungsten Corp.). U. S. 2,319,331, May 18, 1943 (April 28, 1942).—The method of making an abrasive article which comprises preparing abrasive material in the form of a finely divided grit, coating the grit successively with metal, glass, and again metal, mixing the grit so coated with powdered metal adapted to form a mount, pressing the mixture of grit and mount metal into the desired form, sintering the form, and treating it with a solution of ethyl orthosilicate in a manner to fill the pores of the mount.

Abrasive article. GEORGE UPTON (American Sandpaper Co.). U. S. 2,318,907, May 11, 1943 (Sept. 16, 1942).

Buffing wheel and process of making. H. R. BENBOW (Divine Bros. Co.). U. S. 2,318,986, May 11, 1943 (Feb. 1, 1943).

Cleaning devices for tubes. NORTON GRINDING WHEEL CO., LTD. Brit. 552,244, April 7, 1943 (April 16, 1941).

Cylinder honing. V. W. PETERSON AND F. J. DALEY (Hannifin Mfg. Co.). U. S. 2,320,747, June 1, 1943 (Dec. 29, 1938).

Flexible abrasive article. H. P. KIRCHNER (Carborundum Co.). U. S. 2,320,139, May 25, 1943 (Jan. 23, 1941).

Grinder. A. L. EVANS. U. S. 2,319,311, May 18, 1943 (Sept. 17, 1941).

Grinder machine for strip stock, etc. LOUIS ILLMER AND V. R. PALLAS (Pallas assignor to L. T. Pallas). U. S. 2,320,142, May 25, 1943 (July 14, 1941).

Grinding wheels and other abrasive articles. NORTON GRINDING WHEEL CO., LTD. Brit. 552,248, April 7, 1943 (June 19, 1941).

Guard for grinding wheels. F. O. HARRIS. U. S. 2,320,130, May 25, 1943 (March 16, 1942).

Honing apparatus. H. S. INDGE (Norton Co.). U. S. 2,318,831, May 11, 1943 (May 10, 1941).

Honing machine. GEORGE CROMPTON, JR. (Norton Co.). U. S. 2,318,830, May 11, 1943 (July 19, 1938).

Internal keyway grinder. G. B. CARROLL. U. S. 2,319,582, May 18, 1943 (July 7, 1941).

Knife blade grinding machine. H. T. NICHOLAS (Klotz Machine Co.). U. S. 2,318,883, May 11, 1943 (Aug. 3, 1940).

Machine for grinding curved surfaces. A. A. STEIN (Cold Spring Granite Co.). U. S. 2,320,672, June 1, 1943 (Nov. 25, 1940).

Method of and means for setting industrial and other diamonds and hard materials for shaping and finishing purposes. COVENTRY GAUGE & TOOL CO., LTD., AND J. E. WAINWRIGHT. Brit. 552,241, April 7, 1943 (March 19, 1942).

Piston ring honing method. K. W. CONNOR (Micromatic Hone Corp.). U. S. 2,318,837, May 11, 1943 (Jan. 31, 1940).

Portable valve seat grinding means. E. A. HALL (Hall Mfg. Co.). U. S. 2,318,854, May 11, 1943 (Nov. 10, 1941).

Saw-grinding machine. J. B. BIASOTTI. U. S. 2,319,437, May 18, 1943 (Nov. 25, 1940).

Silicon carbide article manufacture. A. H. HEYROTH (Carborundum Co.). Can. 411,899, April 20, 1943 (March 9, 1938). G.M.H.

Treatment of worn abrasive belts. HANS CONRADY (vested in the Alien Property Custodian). U. S. 2,320,569, June 1, 1943 (May 3, 1939).

Vitrified diamond grinding wheels. NORTON GRINDING WHEEL CO., LTD. Brit. 552,246, April 7, 1943 (May 10, 1941).

Wire grinder. J. H. JAECKER. U. S. 2,319,998, May 25, 1943 (July 31, 1941).

Art and Archeology

Adaptation in color space. D. E. SPENCER. *Jour. Optical Soc. Amer.*, **33** [1] 10–17 (1943).—The trichromatic method of color specification is extended to include the effect of the adaptation of the eye. By the introduction of a new concept, the composite stimulus, the investigator is able to represent a color sample and its background by a single new tensor, p^k. A variety of interesting color problems can be handled by the use of this tensor, which is simple and leads to calculations no more complicated than those usually associated with the trichromatic system. Immediate applications are in the specification of color stimuli and the comparison of color samples with the widest range of backgrounds. A.P.

Ceramic tile for exterior mural selected for permanence and color brilliance. ANON. *Ceram. Ind.*, **40** [3] 54–56 (1943).—The production of a 16- x 40- ft. ceramic mural for the new National Broadcasting Co. building in San Francisco is described and illustrated. See "Radio's . . . ," *Bull. Amer. Ceram. Soc.*, **21** [2] 33 (1942). H.T.

Chitqua, the Chinese modeler, and Wang-Y-Tong, the "Chinese Boy." A. J. TOPPIN. *Trans. English Ceram. Circle*, **2** [8] 149–52 (1942).—These persons, who both came to England about the same time (1769) from Canton, have been confused. Chitqua or Tan-Chequa was an accomplished modeler of busts in clay which he afterward colored. Only one is known. Wang-Y-Tong had contacts with Wedgwood. 5 illustrations. L.R.B.

Dated Staffordshire mug in the National Museum of Wales, Cardiff. BERNARD RACKHAM. *Trans. English Ceram. Circle*, **2** [8] 145–48 (1942).—The decoration in enamel colors over the glaze on a K'ang Hsi (1662–1722) bowl is unlike any Chinese work and was first thought to be Indian. In the National Museum of Wales is a salt-glazed half-pint stoneware mug with the royal cipher AR, which had been decorated in 1706 with the arms of Farmer and in color very similar to that on the Chinese bowl. The decoration was therefore done in England in 1706 which the Queen Anne excise mark confirms. An unusual brown salt-glaze teapot in the Victoria and Albert Museum is decorated in a rather similar style. This stoneware shows a decided kinship with fragments of stoneware of the Queen Anne period dug up in Burslem in 1929. The enameler of all three pieces was therefore probably working in North Staffordshire. Germany was the home of this type of decoration, known as *Hausmalerei*. The brothers Elers, Dutch silversmiths of German extraction, settled near Burslem during the reign of William III. One piece attributed to them in the Dresden Porcelain Collection has enamel decoration similar to that on the teapot, and it is possible that the enameler of the Chinese bowl, the mug, and the teapot came over with the Elers. Solon attributed to Elers a teapot in his collection with decoration in the same style. 4 illustrations. L.R.B.

Denison family: structural tile and brick. ANON. *Bull. Amer. Ceram. Soc.*, **22** [6] 167–72 (1943).—Ten photos.

Early Chelsea figures. O. GLENDENNING. *Trans. English Ceram. Circle*, **2** [8] 153–54 (1942).—G. gives a list of published illustrations of 17 figures made by the Chelsea Porcelain Manufactory in its earliest period and designed by the modeler whose characteristic work is a figure of a girl in a swing. L.R.B.

Further history of the Chelsea Porcelain Manufactory. BELLAMY GARDNER. *Trans. English Ceram. Circle*, **2** [8] 136–41 (1942).—According to a deposition by Ann Protin-Sprimont-Chetwood in 1776, her first husband, Nicholas Sprimont, delegated to her the management of the Chelsea Porcelain Manufactory some time before his death in 1771. Francis Thomas was an accountant who rose to become actual manager but was nominally under Mrs. Sprimont. Eleven examples of Chelsea ware of this period are illustrated. L.R.B.

Inscriptions on glass and chinaware. P. I. KIRLIGAN. *Zavodskaya Lab.*, **9** [11–12] 1350 (1940); *Khim. Referat. Zhur.*, **4** [5] 89 (1941).—K. gives experimental results on coloring inscriptions on glass made with the aid of water glass. The coloring is effected with metallic salts. $AgNO_3$ is very effective for yellow-brown. Details of procedure are given. M.Ho.

Limerick delftware. W. B. HONEY. *Trans. English Ceram. Circle*, **2** [8] 155–57 (1942).—Two patterns of dinner plates, decorated with the arms of Edmond Sexton Pery and Francis Pierpoint Burton, members of the Irish House of Commons, made by John Stritch at Limerick in 1761, have come to light, the first 18th-century Irish ware known, apart from delftware made by Henry Delamain at Dublin and at Belfast. The plates are of tin-glazed buff earthenware (delftware), transfer printed from an engraving with other colors added with a brush. Transfer printing was rare at the time, being associated with a Battersea factory of which Jansen, Delamain, and Brooks were proprietors in 1753–1754. It is possible that the engraver of the Limerick plates was Michael Hanbury of Dublin. 2 illustrations. See "Will . . . ," p. 113. L.R.B.

Making Goldscheider ware in America. ANON. *Ceram. Ind.*, **39** [2] 43–44 (1942).—The well-known Austrian pottery is now made in Trenton, N. J. 6 photos. H.T.

Miscellany of pieces. ANON. *Trans. English Ceram. Circle*, **2** [8] 132–35 (1942).—Seventeen pieces of unusual interest or of uncertain attribution are discussed, and 10 are illustrated. L.R.B.

Sixty-year history of glass blowing. J. MORRISON. *Ceram. Ind.*, **39** [4] 58–64; [5] 48–54; [6] 48–52 (1942). —The various methods of making bottles prior to the introduction of machine methods are described, and a short history of the first machines invented is given. Modern glass bottle machines are discussed, and the expansion of the glass industry over the whole country during the last 60 years is shown. H.T.

Surface phenomena in the technology of ceramic colors. I. A. KUDINOV AND V. I. BYALKOVSKIĬ. *Zhur. Priklad. Khim.*, **13** [10] 1428–35 (1940); *Khim. Referat. Zhur.*, **4** [6] 94–95 (1941).—Ceramic colors are generally used in the form of highly dispersed suspensions. The improvement of their qualities, therefore, depends largely on the improvement of the stabilizing conditions of the suspensions. The stability, in turn, is determined by the dispersability of the particles in the suspension and the nature of their molecular surface. To determine the nature of the surface of ceramic colors, their sclerometric hardness was measured in a Kuznetsov apparatus in media of various polarities: air; water; aqueous solutions of sugar, soap, and electrolytes; solutions of oleic and stearic acids; kerosene; turpentine; vaseline; and castor oil. The results showed that the adsorption of surface-active substances by the colors lowers their hardness. The greatest lowering of hardness is caused by the adsorption of slightly polar media. This indicates the hydrophility of ceramic colors. Measurements of the adsorption angle confirm this conclusion. The formation of an adsorbed layer on the surface of the color is accompanied by an inversion of the selective wetting. This property is used by the authors for improving a method for lithographic utilization of the colors. The color is first treated with a solution of oleic or stearic acid in vaseline; this improves its adhesion to hydrophobic films in printing. A method was also worked out for its use in industry. The authors investigated the stabilization of suspensions of ceramic colors in media of various polarities. Stabilizing agents were selected for a bonding medium which increase the degree of dispersion of the suspensions. A 0.1% solution of Na_2CO_3 is an effective stabilizer for ceramic colors; for hydrocarbon suspensions of ceramic colors, stearin is used as a stabilizer. The effectiveness of these stabilizers was checked in production. M.Ho.

Valentine teapot. MRS. WILLOUGHBY HODGSON. *Trans. English Ceram. Circle*, **2** [8] 142–44 (1942).—The potter also used the St. Valentine legend and its associations to inspire decoration. A Worcester teapot made in 1760 (illustrated) and three other examples are described. L.R.B.

John Wall and the Worcester Porcelain Co. C. W. D. PERRINS. *Trans. English Ceram. Circle*, **2** [8] 121–31 (1942).—It was formerly supposed (R. W. Binns, "Century of Potting") that the Worcester Porcelain Co. was founded to exploit a secret process invented by John Wall and William Davis. Old newspaper advertisements in 1750 and 1751 reveal that a firm known as Lowdin's China House in Bristol, making an "imitation of china ware" amalgamated with the Worcester Porcelain Co. just before July 24, 1752. P. suggests that John Wall and William Davis were associated with this factory. The secret for which these two each received £250 when the new company was formed to acquire the Bristol business was the use of steatite (soapy rock from Lizard Point, Cornwall) which Pococke, writing in 1750, said was used at the Bristol pottery. The new facts explain how first-class ware could be made within six months of the acquisition by the Company of a large private mansion in Worcester, as it is clear from the deed of partnership that certain Bristol potters and the materials and equipment from their factory were transferred to Worcester. Analysis of early Bristol and Worcester porcelain by Rackham and Eccles in 1922 showed them to be practically identical. The vicissitudes of porcelain manufacture in Worcester are briefly detailed down to the present day. **Discussion.** MRS. MACALISTER. *Ibid.*, p. 131.—Attention is called to (1) trials of steatite before 1729, recorded by J. Woodward, and (2) Morton Nance's discovery that Benjamin Lund, agent to Lowdin's China House, was granted a license to work steatite at Lizard Point in 1748. L.R.B.

Will of Henry Delamain, the Dublin potter. A. J. TOPPIN. *Trans. English Ceram. Circle*, **2** [8] 158–59 (1942). —Documentary evidence is presented which strongly suggests that Henry Delamain, potter of Dublin, was also a partner in the Battersea Enamel Factory of which it is known that one Delamain was part proprietor. Henry Delamain is known to have purchased "The Art of Printing Earthenware" for which the Battersea factory was well known. See "Limerick . . . ," p. 112. L.R.B.

PATENTS

Casserole design. THOMAS KAPNER AND DAVID KAMENSTEIN. U. S. 135,649, May 11, 1943 (Dec. 31, 1942).

Vase design. CONTE & SALMASO REGISTERED. Can. 13,445 and 13,446, April 15, 1943. G.M.H.

Cements

Cements with an increased alkali content. M. P. SYTIN. *Prom. Stroitel. Materialov*, **1940**, No. 12, pp. 10–12; *Khim. Referat. Zhur.*, **4** [6] 98 (1941).—Within the ternary system SiO_2–$CaO \cdot SiO_2$–$Na_2O \cdot SiO_2$, materials were obtained which had bonding properties. These materials were obtained by calcining various compositions at temperatures exceeding 1100°. The resistance to compression of small specimens after 28 days was 50 to 80 kgm. per sq. cm. M.Ho.

Fast-hardening bauxite-gypsum cement. P. P. BUDNIKOV AND V. K. GUZEV. *Zhur. Priklad. Khim.*, **13** [11] 1582–85 (1940); *Khim. Referat. Zhur.*, **4** [6] 98 (1941). —The authors experimented with a fast-hardening cement composed of bauxite, chalk, and gypsum. The calcination was done at 1280° to 1300°. $CaO \cdot Al_2O_3$, $3CaO \cdot 5Al_2O_3$, $CaSO_4$, and slight amounts of $2CaO \cdot SiO_2$ were found in the product petrographically. This cement has good strength properties and is resistant to corroding waters. The cement was quick setting, but this property diminished after 1 year's storage. See "Activation . . . ," *Ceram. Abs.*, **22** [1] 4 (1943); "White . . . ," *ibid.*, **19** [4] 86 (1940). M.Ho.

High-Pyseal, a new sealing cement. ANON. *Laboratory*, **14** [1] 14–15 (1943).—High-Pyseal, a general laboratory cement melting at about 80°C., extends the field of use of the original Pyseal cement, which melts at about 58°C. W.D.F.

Investigation of low-heat cements. YU. M. BUTT. *Trudy Moskov. Khim.-Tekh. Inst. Mendeleeva*, **1940**, No. 8, pp. 82–83; *Khim. Referat. Zhur.*, **4** [6] 97 (1941).—The investigation was conducted with the purpose of choosing a suitable cement for the foundations of the Palace of the Soviets. The cement was to be distinguished by low thermal conductivity, sufficient strength, and resistance to salts. Portland and pozzuolanic cements having low heat conductivity were used for the foundations. M.Ho.

Modern developments in cements in relation to concrete practice. F. M. LEA. *Jour. Inst. Civil Engrs.* [London], **19** [4] 224–74 (1943).—The development of the several types of cement in addition to Portland cement is con-

sidered from the aspect of their chemical constitution, but only insofar as divergencies in application and use have occurred. A description of the compounds present in the main types shows that developments to suit different engineering requirements, such as (1) concreting at low temperature, (2) the placing of mass concrete, and (3) resistance to sulfate attack, depend on the results of fundamental research into the properties of the individual compounds. These three topics are considered at length. In the future, a method must be found for accelerating the rate of hydration and hardening of dicalcium silicate in Portland cement to give fairly high early strength and low heat evolution. Supersulfated cements combine a favorable rate of strength development and low heat evolution, but it has not yet been proved that they possess the resistance to cracking and general suitability for mass concrete work possessed by low-heat Portland and pozzuolanic cements. It is believed that cements of greater extensibility without reduction of the rate of strength development may be produced. Calcium sulfate addition to neutralize drying shrinkage may be useful in patching cements but perhaps not for general use. Extensibility may also be obtained by additions to the mix of rubber latex or bitumen, and chemical resistance by the addition of fatty or resinous materials, on which further research should be made. L.R.B.

New standard on gypsum lath. ANON. *Architectural Record*, **88** [1] (1943).—Some new standards for gypsum lath developed under the leadership of the American Society for Testing Materials and approved by the American Standards Assn. are mentioned. N.R.S.

Raw material for white Portland cement. P. G. VYSOTSKIĬ. *Prom. Stroitel. Materialov*, **1940,** No. 12, pp. 8–10; *Khim. Referat. Zhur.*, **4** [6] 97–98 (1941).—V. describes experiments in producing a white Portland cement from Ermachikhinsk and Orsk clays and Shiryaevs lime. If the conditions in the furnace were oxidizing, the clinker was yellow. In a reducing atmosphere, the clinker was light green. The addition of $K_2Cr_2O_7$ imparted a permanent green color to the cement. M.Ho.

BOOK

Keene Cement Craft. O. ARNOLD RADTKE. Bruce Publishing Co., Milwaukee, 1943. 115 pp., 90 illustrations. Price $2.00.—New uses for a material whose interesting possibilities are not widely enough known are presented for the amateur craftsman in this unusual book. R. shows how Keene cement can be fashioned into small projects which, in their marblelike appearance, are as beautiful as they are inexpensive and practical. For each project there is an introduction giving general details and suggestions concerning the particular marble effect to be attained. In addition, R. offers comprehensive bills of material and step-by-step directions for constructing the molds, mixing in the colors, casting the cement, removing the casts, and polishing the objects to a high luster. Ample illustrations provide all the visual aids that the amateur craftsman needs. Among the projects included are a great variety of useful things such as penholders, ash trays, book ends, lamps, candlesticks, and vases, all of which can be made in an infinite selection of color combinations. After experiments with Keene cement for a number of years in his own school shop with eighth-grade boys, R. decided to open to others this avenue of experimentation with a medium that is inexpensive and that can be conveniently worked with the hand tools found in the woodworking shop at school and at home.

Enamel

Architect looks at porcelain enamel. MORRIS KETCHUM, JR. *Enamelist*, **20** [6] 11–13 (1943). L.E.T.

Conversion from porcelain enameling to heat-treating is excellent job. ANON. *Enamelist*, **20** [7] 14–20 (1943).—A description of the conversion from porcelain enameling to the heat-treatment of steel armor plate and other war materials at the Co-operative Enameling Co., Cleveland, Ohio, is given. Changes in furnaces, such as the conversion of the continuous furnace into a car tunnel furnace, and the installation of testing equipment, such as Brinell hardness testers, etc., were necessary. L.E.T.

De-enameling ingenuity will save a lot of steel. G. DYER. *Ceram. Ind.*, **39** [2] 60, 64 (1942). H.T.

Enamel industry answers the question about its postwar future. ANON. *Ceram. Ind.*, **40** [2] 22–24 (1943).—The future of the enamel industry after the war is bright. It should continue its present contacts to regain lost markets. H.T.

Enameling aluminum. P. EYER. *Emailwaren-Ind.*, **18,** 103 (1941); abstracted in *Chem. Zentr.*, **1942, I** [25] 3132.—Because of the low melting point of Al, it can be coated with only those enamel glazes which are stable to neither acids nor water and therefore have merely a decorative value. Swiss Patents 79,967 and 85,577 of the year 1919, which deal with the enameling of Al, are referred to. In the first instance sand and minium are used; in the second, boric acid and minium. M.V.C.

Enamelist's-eye view of the building industry. ROBERT A. WEAVER. *Enamelist*, **20** [6] 7–9, 46–48 (1943). L.E.T.

New finish for metal. ANON. *Ceram. Ind.*, **40** [4] 77–78 (1943).—Armor-Vit is a new coating developed for metal products. It is an alkali alumina silicate, originating from an oil-bearing halloysite, which is sprayed onto the metal part and heated to 750° to 800°F. The resulting coating is insoluble in boiling water and highly resistant to most acids and alkalis. H.T.

Outlook for porcelain enamel in industrial construction. ALBERT KAHN. *Enamelist*, **20** [6] 16–18 (1943). L.E.T.

Porcelain enamel in the house of the future. DON GRAF. *Enamelist*, **20** [6] 20–23, 50 (1943). L.E.T.

Postwar enamel market will depend on what the industry does today. R. A. DADISMAN. *Ceram. Ind.*, **40** [5] 45–46 (1943). H.T.

War-conversion problems of an enamel plant. WILLIAM T. WINAND. *Ceram. Ind.*, **39** [2] 58 (1942); see "Enameling . . . ," *Ceram. Abs.*, **22** [5] 68 (1943). H.T.

You don't need a special furnace to anneal or heat-treat metals. G. B. BERLIEN. *Ceram. Ind.*, **39** [2] 62–64 (1942).—The war forces the use of enameling and similar furnaces for the annealing of steel. H.T.

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Enameled oven door. J. H. REIFENBERG (Canadian Westinghouse Co., Ltd.). Can. 411,759, April 13, 1943 (July 6, 1940; in U. S. July 13, 1939). G.M.H.

Opacifier and porcelain enamel containing it. G. H. MCINTYRE AND M. J. BAHNSEN (Ferro Enamel Corp.). U. S. 2,319,247, May 18, 1943 (June 26, 1940).—As an addition opacifier for porcelain enamels, the product resulting from the substantially complete sintering of about the theoretical amounts of raw material required for the production of a product having the general formula $XF_4 \cdot YO \cdot ZO_2$, where X is enough atoms of at least one alkaline metal selected from the first and second groups of the periodic system to satisfy the valency of the four atoms of fluorine, Y is enough atoms of at least one alkaline metal selected from the first and second groups of the periodic system to satisfy the valency of the one atom of oxygen, and Z is enough atoms of at least one element selected from the class consisting of Si, Zr, and Ti to satisfy the valency of the eight atoms of oxygen.

Glass

Ammonium nitrate as substitute for sodium nitrate in copper ruby glass. I. P. Nikol'skiĭ. *Prom. Stroitel. Materialov*, **1940**, No. 12, p. 67; *Khim. Referat. Zhur.*, **4** [5] 88 (1941). M.Ho.

Canada produces optical glass for wartime purposes. Anon. *Ceram. Ind.*, **39** [3] 31–33 (1942).—The glass plant of Research Enterprises, Ltd., is combined with an optical instrument plant where complete instruments are manufactured. 4 photos. See "Organization . . .," *Ceram. Abs.*, **21** [8] 167 (1942). H.T.

Cerium—logical arsenic substitute in glass batches. Anon. *Ceram. Ind.*, **40** [3] 37–38 (1943).—Cerium oxide is a suitable substitute for arsenic in soda-lime glass batches. It produces a stable glass. It is a chemical decolorizer which exerts an oxidizing influence on the iron content of the glass. See "Decolorization. . .," *Ceram. Abs.*, **22** [6] 100 (1943). H.T.

Determination of some physical and chemical properties of glass fiber. M. A. Bezborodov and A. I. Ramlau. *Zavodskaya Lab.*, **10** [2] 182–85 (1941); *Khim. Referat. Zhur.*, **4** [9] 109 (1941). M.Ho.

Does light have any effect on glass-packed foods? John J. Powers and William B. Esselen, Jr. *Ceram. Ind.*, **39** [2] 36–38 (1942).—The effect of light on glass-packed foods is negligible. Most undesirable changes are due to heat and oxygen. It is concluded that food can be packed as satisfactorily in glass as in tin containers. H.T.

Effect of alumina and magnesia on the chemical resistance of window glass. M. A. Bezborodov. *Nauch.-tekh.-konferentsiya v Svyazi s 40-letniĭ Yubileĭ Uchebno-Nauch. Deyateln. Tomsk. Ind. Inst.*, **1940**, p. 98; *Khim. Referat. Zhur.*, **4** [4] 100 (1941). M.Ho.

Effect of NaCl in Na_2SO_4 on the quality of glass. I. G. Bespalov. *Zhur. Khim. Prom.*, **18** [5] 14–15 (1941); *Khim. Referat. Zhur.*, **4** [7–8] 93 (1941).—The existing standard limits the NaCl in the Na_2SO_4 used in the glass industry to 2%. B. experimented with glass made from sulfate containing 7% NaCl and sand containing up to 3% Fe_2O_3. The results show that the presence of NaCl in the sulfate has a favorable effect on the decolorization of glass. He derived a series of equations by which the reaction between NaCl and Fe_2O_3 may proceed and shows that an exhaustive study of this problem will determine the conditions for the complete deferrizing of sands. M.Ho.

Effect of pH of suspensions of crocus on its polishing properties. T. E. Golba. *Stekolnaya Prom.*, **1940**, No. 11–12, pp. 22–24; *Khim. Referat. Zhur.*, **4** [6] 94 (1941).—The investigation was conducted at the Institute of Glass to study the effect of the medium in which the crocus is suspended on its polishing action. The suspensions investigated had a pH of 1 to 13. The effectiveness of polishing was determined by ascertaining the loss in weight of a glass plate in a definite time. The laboratory results indicate that the pH of the crocus suspension has a marked influence on its polishing properties. Polishing suspensions with a pH of 3.0 to 4.0 were most effective. The best surface (of the glass) was observed with suspensions having a pH of 5.0 to 5.4. The laboratory results were subsequently checked under production conditions. M.Ho.

Effect of polishing on chemical durability of glass surfaces. A. E. Badger and L. G. Farber. *Ceram. Ind.*, **40** [2] 34 (1943).—Polishing agents aid in giving glass surfaces more resistance to acids. H.T.

Fine glass filaments made stronger and less brittle. Anon. *Science News Letter*, **43** [14] 217 (1943).—Fine glass filaments can be made stronger and less brittle by a German process. Two kinds of glass of different coefficients of expansion are delivered in molten condition simultaneously by two concentric nozzles. The resulting filament has a strong sheathed-core structure. In another method of manufacture, a rod with a core of a second kind of glass is heated and spun out. G.A.K.

Glass fibers, glass wool, and spun glass for general and industrial use. V. Oĭllerikh. *Stekolnaya Prom.*, **1940**, No. 11–12, p. 31; *Khim. Referat. Zhur.*, **4** [6] 94 (1941). M.Ho.

Glass strain. H. J. Nolte. *Gen. Elec. Rev.*, **46** [5] 275–82 (1943).—N. describes a simple method that can be used in factories for determining and analyzing glass strains in electronic tubes and other glass forms. The instrument, called an "Open-Polaroids Polariscope" is described in detail with a diagram. 12 illustrations. L.E.T.

Glass as a substitute material. Anon. *Vierjahresplan*, May, 1940; translated in *Ceram. Ind.*, **40** [4] 90–92 (1943).—Novel applications of glass in Germany are discussed. 2 photos. H.T.

Heat conductivity of molten glass. V. G. Gutop. *Stekolnaya Prom.*, **1940**, No. 11–12, pp. 24–27; *Khim. Referat. Zhur.*, **4** [6] 94 (1941).—A method is given for investigating the heat conductivity of glass masses at high temperatures. The investigation was conducted with five compositions of glass in the region of 500° to 1500°, using an apparatus purposely constructed by G. The coefficient of thermal conductivity of molten glass increases with an increase in temperature. The presence of CaO in the glass causes a greater increase of the coefficient with temperature. Substituting Na_2O and CaO for SiO_2 causes a lowering of the thermal conductivity. This decrease at high temperatures is relatively less when SiO_2 is replaced by CaO. Replacing Na_2O by CaO causes an increase in the thermal conductivity of glass. M.Ho.

Heat-resistant glassware. S. G. Lioznyanskaya. *Legkaya Prom.*, **1941**, No. 1, pp. 33–35; *Khim. Referat. Zhur.*, **4** [7–8] 93 (1941). M.Ho.

Insulating glass. N. Gusev. *Novosti Tekhniki*, **1941**, No. 3, pp. 32–33; *Khim. Referat. Zhur.*, **4** [7–8] 94 (1941).—A new kind of double glass was developed in the laboratory. It is composed of two sheets of ordinary glass. On the periphery of these sheets are placed spacers having a width of 15 mm. and a thickness of 1.5 to 3 mm. The space between the two sheets is filled with a thin layer of glass wool or fiber. This glass is quite translucent and is a good heat and sound insulator. The total thickness of the glass is 4.5 to 7 mm. It is suitable for single-pane lanterns and factory windows. M.Ho.

Low-expansion vitreous bodies are resistant to heat shock. A. E. Badger. *Ceram. Ind.*, **40** [3] 49 (1943).—Powdered vitreous silica and powdered borosilicate glass are used as the chief ingredients in ceramic ware fired to 1350°C. for 2 min. H.T.

New burners, batch feeders increase bottle plant melting capacity. Anon. *Ceram. Ind.*, **39** [2] 32–34 (1942). H.T.

On what does the Institute of Glass work? M. A. Tsaritsyn. *Legkaya Prom.*, **1941**, No. 2, pp. 36–38; *Khim. Referat. Zhur.*, **4** [9] 109 (1941). M.Ho.

Performance of tank blocks in glass furnaces. Report of Refractories Committee. J. H. Partridge, *Chairman*. *Jour. Soc. Glass Tech.*, **26** [117] 78–90P (1942).—Data have been collected on the performance of tank blocks in a number of tank furnaces melting soda-lime-silica glass. The primary conclusion that can be drawn from the data is that it is possible to represent in diagrammatic form a relation between furnace life and average rate of glass discharge (provided the life figures are corrected to allow for variability in original thickness of tank blocks) and the statistical limits within which 19 out of 20 results will fall. Results outside these limits may be regarded as indicating a performance either better or worse than the commercially attainable standard and would direct attention to other causes for the different performance. The graph connecting corrected life and rate of discharge correlates 11 furnaces out of 16 belonging to 7 glassworks out of 8, and it can be either a straight line or a hyperbola. The latter possibly gives the more accurate representation, especially if extrapolation to extreme limits of furnace operation be considered. At the present stage of the in-

vestigation, such a graph, which assumes equal merit for all furnaces associated with it, appears to be a more satisfactory method of representing the performance of tanks than the assigning of a figure of merit. Examination of further data on somewhat similar lines in the future will determine with greater certainty whether or not the proposed curves correlating corrected life and rate of discharge are a reliable guide to tank-block performance. R.H.B.

Project for melting glass in a weighed state. F. G. SOLINOV. *Trudy Moskov. Khim.-Tekh. Inst. Mendeleeva*, **1940**, No. 6, pp. 156–59; *Khim. Referat. Zhur.*, **4** [7–8] 93 (1941). M.Ho.

Rapidity of hardening of glass and its mechanical strength. I. A. SMIRNOVA. *Trudy Moskov. Khim.-Tekh. Inst. Mendeleeva*, **1940**, No. 6, pp. 93–102; *Khim. Referat. Zhur.*, **4** [9] 109 (1941).—The purpose of the investigation was to produce a glass with high mechanical and thermal strengths by creating artificial strains. S. fused two or more layers of glasses having the same coefficient of expansion but various rates of solidification. The resistance to shock of these glasses was appreciably higher than that of the usually heated and annealed glass. M.Ho.

Standby systems solve fuel problems for two glass plants. ANON. *Ceram. Ind.*, **39** [3] 34–36 (1942).—To avoid shutdowns due to fuel shortage, glass manufacturers provide standby fuels. A description of a butane-propane gas unit and of a standby oil installation is given. 6 photos. H.T.

Substitute container closures will increase use of glass in 1943. ANON. *Ceram. Ind.*, **40** [2] 28–29, 32 (1943).—To save more metal, new closures for glass containers made of glass, whiteware, wood, paper, or plastic have been developed. 2 photos. H.T.

Testing glass pharmaceutical ampoules. OSCAR KNAPP. *Keram. Rundschau*, **45** [51] 589–90; [52] 600–603 (1937).—There is no international standard method for testing the minimum alkali content and chemical resistance of ampoule glass, although factories in different countries send their produce all over the world. Qualitative methods (the American, Italian, German, British, Anneler, and Mauri methods) and quantitative methods (Mylius extraction test, determination of the pH value, and the "gravel" test of the Deutsche Glastechnische Ges.) are described. K. points out the desirability of a single standard method and proposes a suitable method which is based on the English titration method, where the test solution is titrated back after the heat-treatment and then evaluated numerically. See "Testing. . .," *Ceram. Abs.*, **20** [5] 114 (1941). M.V.C.

Theoretical aspects of chemical attack of glasses by water. A. K. LYLE. *Jour. Amer. Ceram. Soc.*, **26** [6] 201–204 (1943).—Four figures, seven references.

Thermal inhomogeneity of molten glass and means of eliminating it. S. I. KOROLEV AND T. D. IVANOVA. *Prom. Stroitel. Materialov*, **1941**, No. 3, pp. 55–57; *Khim. Referat. Zhur.*, **4** [9] 109 (1941). M.Ho.

Thermal stability of Se ruby. P. V. BUKARINOVA AND A. A. KEFELI. *Stekolnaya Prom.*, **1940**, No. 11–12, pp. 27–30; *Khim. Referat. Zhur.*, **4** [6] 94 (1941).—The authors investigated the effect of B_2O_3 on the color of Se ruby and on the increase of its thermal resistance. The B_2O_3 was added in place of Na_2O. The glasses prepared contained 5, 10, 15, and 20% B_2O_3 and, correspondingly, 20, 15, 10, and 5% Na_2O. The authors recommend a glass of the following composition: SiO_2 67, B_2O_3 15, ZnO 10, Na_2O 8, Se 0.6, CdS 0.8, and $CdCO_3$ 1%. See "Antimony. . .," *Ceram. Abs.*, **19** [6] 135 (1940). M.Ho.

Transformation region of glass. ANIUTA WINTER. *Jour. Amer. Ceram. Soc.*, **26** [6] 189–200 (1943).—Fifteen figures, eight references.

Viscosity and working characteristics of glasses: I, Viscosity of some commercial glasses at temperatures between approximately 500° and 1400°. JAMES BOOW AND W. E. S. TURNER. *Jour. Soc. Glass Tech.*, **26** [117] 215–40T (1942).—As the preliminary to a systematic review of the relationship between the viscosity of a mass of glass (or, more strictly, between the viscosity at different points of the mass) undergoing manipulation by hand or machine and the temperature ranges between which the various stages of manipulation can be satisfactorily carried out, the viscosities of 24 glasses, 3 of them synthesized from pure materials and 21 of different types employed commercially, were determined by two precision methods, the Margules method for temperatures from approximately 750° to 1400° and a fiber extension method for temperatures from approximately 500° to 800°. From the results, factors were derived for the oxides SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, Na_2O, and PbO by which, within prescribed limits of composition, the viscosities of glasses containing them can be calculated. R.H.B.

BOOKS

Introduction to the Physical Chemistry of Glass. B. YA. BLYUMBERG. Goskhimizdat., Leningrad, 1940. 176 pp. Price 8.75 R. Reviewed in *Khim. Referat. Zhur.*, **4** [9] 109 (1941). M.Ho.

Manual of Laboratory Glass Blowing. R. H. WRIGHT. Chemical Publishing Co., Inc., New York, 1943. 104 pp. Price $2.50.—Laboratory glass blowing, like most arts, tends to change its objectives and methods in response to changing demands on its practitioners and changing resources open to them. Whereas many of the manuals of the past dealt extensively with the making of such things as stopcocks and even thermometers and had little or nothing to say of the apparatus used in, e.g., vacuum work, it is now possible to buy many of the things that formerly had to be made, and the laboratory glass blower is more often called upon to produce special apparatus for special purposes. The operations described in this book reflect the change. The first two chapters give a short, and, as far as possible, nontechnical account of materials, glass, and gas used by the glass blower, and are intended to answer most of the "whys" in the later chapters. The tools required for ordinary work in a physical or chemical laboratory are described, and the fundamental operations which form the bases of all that follows are outlined. It is hoped that the descriptive matter when taken in conjunction with the photographs will enable the beginner to "start from scratch." Instructions are also given for the more advanced and some special operations.

Manufacturing Colored Glass. V. V. VARGIN. Edited by I. V. Grebenshchikov. Gosudarst. Izdatel'stvo Legkoĭ Prom., Moscow, 1940. 284 pp. Price 12.65 R. Reviewed in *Khim. Referat. Zhur.*, **4** [7–8] 93 (1941). See "Manufacture. . .," *Ceram. Abs.*, **17** [6] 216 (1938). M.Ho.

PATENTS

Apparatus and method for producing one-piece multifocal lens blanks and lenses. F. E. DUCKWALL (Continental Optical Co., Inc.). U. S. 2,319,922, May 25, 1943 (May 17, 1940).

Apparatus for tempering flat glass. G. W. T. BIRD (American Securit Co.). U. S. 2,318,584, May 11, 1943 (March 6, 1940).

Building block. E. T. PUTNAM (Libbey-Owens-Ford Glass Co.). U. S. 2,319,345, May 18, 1943 (May 25, 1940).

Chemical composition. A. G. PINCUS (American Optical Co.). U. S. 2,319,260, May 18, 1943 (Nov. 10, 1939).—The process of forming a unitary vitreous chemical composition, which is soluble to a marked extent in water and is adapted to act as a cleaning agent and as a water-softening agent, comprising forming a mixture consisting of silica within the range of 50 to 80% by weight, sodium carbonate of an amount sufficient to yield 20 to 50% by weight of sodium oxide, and an ingredient resulting in phosphorus pentoxide of a fraction of 1 to 12% by weight, fusing the mixture, and so controlling the temperature of fusion within some narrow range between 1800° and 2800°F. according to the particular batch being melted so as to produce a unitary vitreous composition.

Coated glass fabric upholstery. C. S. HYATT AND T. J. KERR (Columbus Coated Fabrics Corp.). Can. 412,425, May 11, 1943 (Jan. 6, 1941; in U. S. Dec. 2, 1940). G.M.H.

Electric glassmelting furnace. L. H. DAVIS (Newton Research Laboratories, Inc.). Can. 411,805, April 13, 1943 (Jan. 7, 1942). G.M.H.

Fluorescent tube. J. W. MARDEN (Canadian Westinghouse Co., Ltd.). Can. 411,761, April 13, 1943 (July 22, 1941). G.M.H.

Glass article handling method and apparatus. L. N. POND (Corning Glass Works). Can. 412,260, May 4, 1943 (May 6, 1941; in U. S. May 18, 1940). G.M.H.

Glass conducting means and molding apparatus. H. K. RICHARDSON AND L. D. MORAND (Canadian Westinghouse Co., Ltd.). Can. 411,758, April 13, 1943 (Sept. 22, 1939). G.M.H.

Glass fiber thread forming method. W. M. CAMP (Clark Thread Co.). Can. 411,625, April 6, 1943 (Feb. 19, 1941; in U. S. March 14, 1940). G.M.H.

Glassmelting method. L. H. DAVIS (Newton Research Laboratories, Inc.). Can. 412,451, May 11, 1943 (Feb. 13, 1941). G.M.H.

Glass-pressing apparatus. R. A. HINKLEY AND W. C. WEBER (Corning Glass Works). Can. 412,426, May 11, 1943 (Aug. 24, 1939; in U. S. Sept. 7, 1938). L. F. GOODRICH (Corning Glass Works). Can. 412,427, May 11, 1943 (May 15, 1941). G.M.H.

Glass tank furnace. JOSEPH ROMAZZOTI (Soc. Anon. des Manufactures des Glaces & Produits Chimiques de St.-Gobain, Chauny & Cirey). Can. 411,685, April 6, 1943 (June 25, 1940). G.M.H.

Glassware durability increasing method. W. K. BERTHOLD (Hartford-Empire Co.). Can. 411,783, April 13, 1943 (Dec. 15, 1941). G.M.H.

Glassworking apparatus. H. H. BLAU AND R. W. KELL (Corning Glass Works). Can. 412,259, May 4, 1943 (Feb. 28, 1941; in U. S. March 7, 1940). G.M.H.

Laminated glass and method of making. J. C. CROWLEY. U. S. 2,319,534, May 18, 1943 (Sept. 25, 1939).

Lens grinding and polishing machine. E. M. LONG (Shuron Optical Co., Inc.). U. S. 2,319,417, May 18, 1943 (Nov. 27, 1941).

Luminaire. T. W. ROLPH (Holophane Co., Inc.). U. S. 2,318,715, May 11, 1943 (Oct. 5, 1940). U. S. 2,318,716, May 11, 1943 (July 5, 1941).

Machines for making glass bottles, jars, etc. CANNING TOWN GLASS WORKS, LTD., P. J. WATSON, AND F. H. HONEY. Brit. 552,103, April 7, 1943 (March 2, 1942).

Manufacture of ceramic bodies. PHILIPS LAMPS, LTD. (N. V. Philips' Gloeilampenfabrieken). Brit. 552,719, May 5, 1943 (Oct. 14, 1941).

Manufacture of plate-shaped ceramic objects. PHILIPS LAMPS, LTD. (N. V. Philips' Gloeilampenfabrieken). Brit. 552,776, May 5, 1943 (Nov. 17, 1941).

Means for and method of manufacturing mineral wool felted materials. D. C. DRILL (American Rock Wool Corp.). U. S. 2,319,666, May 18, 1943 (Feb. 14, 1941).

Means for testing articles such as glass bottles by impact. BRITISH HARTFORD-FAIRMONT SYNDICATE, LTD. (F. W. Preston). Brit. 552,544, April 29, 1943 (Feb. 13, 1942).

Method of and apparatus for making glass. HARTFORD-EMPIRE CO. Brit. 551,945, March 31, 1943 (March 1, 1941).

Quartz lamp mount. D. S. GUSTIN AND G. A. FREEMAN (Canadian Westinghouse Co., Ltd.). Can. 411,760, April 13, 1943 (April 24, 1941). G.M.H.

Roof and roofing material. D. E. GRAY (Corning Glass Works). U. S. 2,319,857, May 25, 1943 (Aug. 23, 1940).

Tempered hollow glass articles. PILKINGTON BROS., LTD. (Corning Glass Works). Brit. 552,006, March 31, 1943 (May 11, 1942).

Structural Clay Products

Ventilated design for windowless walls. ANON. *Eng. News-Record*, **130** [14] 500-501 (1943).—The new Douglas aircraft plant in Oklahoma meets the requirements of critical-materials conservation by using brick instead of sheet-steel walls. Walls 50 ft. high contain tile flues for ventilation and a 4-in. blanket of rock wool. White cement floors, light-green painted walls, and an exposed ceiling blanket of glass wool aid light reflection. Illustrated. G.A.K.

Walls of the future. ANON. *Science News Letter*, **43** [18] 276–77 (1943).—By sandwiching light-polarizing material in glass and then crossing two plates in a double-wall construction, an opaque partition is obtained. When one of the plates is slid back, the partition will become transparent. Colored plate-glass walls, glass floors, tempered-glass doors, glass brick and hollow tile, and glass wool are envisioned in homes of the future. G.A.K.

PATENTS

Brick. MARTIN BRANHAM. U. S. 2,319,203, May 18, 1943 (April 16, 1940).

Vapor-glazed ceramic product and method for producing. W. S. RAMSAY AND G. A. BOLE (Stark Brick Co.). U. S. 2,320,099, May 25, 1943 (Sept. 24, 1940).—The method of salt glazing ceramic ware which consists in forming the ware with the surfaces thereof composed of a material which vitrifies when fired, spraying a solution containing a zinc salt upon the surfaces of the ware prior to its firing, and volatilizing sodium chloride in a kiln containing the ware during the firing thereof.

Refractories

Chrome-free magnesite block for metal furnaces. ANON. *Tech. Z. Prakt. Metallbearbeit.*, **51**, 638–39 (1941); abstracted in *Chem. Zentr.*, **1942, I** [25] 3132.—A short report is given on the use of a specially made Cr-free block (manufacturing process not given) which not only has a higher stability to firing under load and is practically unaffected by FeO and lime fumes but also has the required resistance to temperature change and is entirely stable to reducers; the latter factor is important in the case of many Siemens-Martin furnaces, especially electric furnaces. M.V.C.

Dinas with a siliceous bonding material. T. V. MEMNONOVA. *Sbornik Nauch.-Tekh. Stateĭ KMZ*, **1940**, No. 3, pp. 129–34; *Khim. Referat. Zhur.*, **4** [5] 89–90 (1941).—Lime used as bonding material in the preparation of Dinas lowers the refractoriness of the product appreciably. At the Kuznetskiĭ Metallurgicheskiĭ Zavod, Dinas was prepared using a siliceous bonding material made from Anzhero-Sudzhensk quartzite; 3 to 5% of a siliceous slurry was used in the preparation of the batch of quartzite, and 2% coke was added to one of the batches to increase the thermal resistance of the product. The laboratory experiment resulted in a product with a higher refractoriness (over 1770°) and a high mechanical strength. See *Ceram. Abs.*, **22** [1] 10 (1943). M.Ho.

Dolomite brick for use in steelworks. T. SWINDEN AND J. H. CHESTERS. *Jour. Iron & Steel Inst.*, **144** [2] 105–18P (1941); abstracted in *Iron & Coal Trades Rev.*, **143** [3838] 257–59 (1941); *Iron & Steel*, **15** [3] 81–86 (1941); *Brit. Steelmaker*, **7** [10] 203 (1941); *Brit. Clayworker*, **50** [598] 114–17 (1942); *Engineering*, **153** [3989] 505; **154** [3990] 5 (1942).—Experiences with stable and semistable dolomite brick are discussed, and greater use of such products is recommended because of the present

economical condition of Great Britain. The problem lies in the fact that high-temperature calcination (or even electrical fusion) of dolomite does not yield a stable product. Both the magnesia and the lime formed by the reaction $CaCO_3 \cdot MgCO_3 \rightleftharpoons MgO + CaO + 2CO_2$ are of moderate crystal size (about 0.05 mm. in diameter), but the lime hydrates readily and samples of basic brick made in this manner start to disintegrate after only a few days' exposure to the atmosphere. Experiments to find a stabilization process led to a composition in which all the lime was combined but no unstable dicalcium silicate was present and in which the principal constituents in the clinker were tricalcium silicate ($3CaO \cdot SiO_2$) and magnesia, the reaction involved being principally as follows:

$$\underset{\text{Dolomite}}{6(CaCO_3 \cdot MgCO_3)} + \underset{\text{Serpentine}}{3MgO \cdot 2SiO_2 \cdot 2H_2O} \rightarrow 2(3CaO \cdot SiO_2) + 9MgO + 2H_2O + 12CO_2.$$

Such stabilized magnesite brick have given encouraging results in preliminary trials in tilting furnace back walls. A comparison of basic open-hearth furnace bottom brick is given in the following table:

	Special magnesite brick	Ordinary magnesite brick	Typical stabilized brick	Dolomite
	Code No.			
	M4	M17	X6	X7
Apparent porosity	24.2	18.7	22.1	24.7
Bulk density (lb./ft.³)	167	181	161	158
Apparent specific gravity	3.52	3.56	3.31	3.36
Cold crushing strength, 9 x 4½ x 3 in., on end (lb./in.²)	7170	>8300	>8300	5090
Permeability to air, perpendicular 9- x 3-in. face, through 1 skin (c.g.s. units)	0.08	0.12	0.088	0.12
Aftercontraction, 2 hr., 1500°C. (%)	1.0	0.1	0.0	0.2
Refractoriness under load (maintained temp. test, 25 lb./in.² at 1600°C.)	Failed in 11 min.	Not determined	Failed in 32 min.	Failed in 11 min.
Rising temp. test, 50 lb./in.² (°C.)				
Initial softening		1450	1540	1460
Rapid softening		1520	1610	1510
Failure		1540	1680	1600
Thermal shock resistance (reversals required to produce failure)	>30	7	2	3

See "Steelworks . . ," *Ceram. Abs.*, **18** [4] 103 (1939); "Introduction . . . ," *ibid.*, **19** [5] 115 (1940). M.Ha.

Effect of corrosion on grog in the dome of a cupola furnace of the Chimkent lead smelter. B. V. Ivanov. *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk*, **1940**, No. 6, pp. 15–22; *Khim. Referat. Zhur.*, **4** [5] 116 (1941).—Grog brick in the cupola is corroded at temperatures exceeding 1000°. PbO reacts with the SiO_2 of the brick, forming a series of lead glasses. These are easily melted out along with parts of the refractory. The question is raised whether periclase, andalusite, mullite, and other brick would not be preferable. See "Mineral. . .," *Ceram. Abs.*, **21** [7] 144 (1942); "Service. . .," *ibid.*, [9] p. 191. M.Ho.

Forsterite refractories. A. S. Berezhnoĭ. *Sbornik Rabot Ukrain. Nauch.-Issledovatel. Inst. Ogneuporov & Kislotouporov*, **1940**, No. 46, pp. 87–116; *Khim. Referat. Zhur.*, **4** [9] 110 (1941).—B. gives the results of his experiments on the production of fired and green forsterite refractories from dunite and olivinite. The dunite products were best when fired at 1670° to 1720° for 6 hr. The olivinite were fired at 1600°. Comparing the processes of their preparation and the properties of the products, B. prefers refractories made from olivinite. He also experimented with combined magnesite-forsterite refractories and found them preferable to forsterite refractories, as they fire better and have a higher thermal resistance. Unfired masses are suitable for the walls of open-hearth furnaces. See "Spinel. . .," *Ceram. Abs.*, **19** [3] 68 (1940); "Service. . .," *ibid.*, **20** [6] 147 (1941); "Substitute. . .," *ibid.*, **21** [11] 235 (1942). M.Ho.

Investigation of refractory materials. T. N. Polubo-yarinov. *Trudy Moskov. Khim.-Tekh. Inst. Mendeleeva*, **1940**, No. 8, pp. 85–88; *Khim. Referat. Zhur.*, **4** [7–8] 94–95 (1941).—The following investigations in ceramic technology at the Moscow Chemical-Technological Institute are briefly discussed: (1) frost resistance of grog refractories, (2) methods for determining the abrasion of refractory material, (3) a dynamic method for determining the glass resistance of refractories, (4) method for determining gas permeability, (5) destructive effect of the Bela reaction, (6) slag corrosion of grog products, (7) increasing the slag resistance of refractories, and (8) the pyrochemical activity of fuel slags. M.Ho.

New Barmston insulating brickworks at Washington Station, Co. Durham. Anon. *Claycraft*, **16** [7] 249–53 (1943).—A description is given of the manufacture of insulating brick by Newalls Insulation Co., Ltd. The factory is of single-story construction, 503 ft. long by 88 ft. wide, and has an output of 6 million brick per year. Raw materials are received at each side of the building and delivered to a batch mixer. Forming is done in an auger-type extrusion machine with an automatic cutting table. Driers consist of 14 chambers capable of drying 120,000 brick per week. Live steam is used for drying. The 32-chamber continuous-type gas-fired kiln is insulated in the foundation walls and roof. Insulating brick for use up to 1600° and 2200°F. are made. 5 photos. G.A.K.

Patching cements. S. Tweedy. *Gas World* [Coking Section], **31** [359] 7–12 (1943).—Since silica brick have come into universal use for coke-oven walls it has not been desirable to cool the oven before repair, and hot patching has been developed. To reduce this necessity to the minimum it is advisable to make periodic inspections, thus eliminating any but small thin patches, which are the most durable. Three methods are used: (1) cement-spraying method, (2) spray-welding method, and (3) troweling method, mainly for oven-door jams. In method 1 a wet mist of cement is sprayed on, and in method 2 a dry mixture passes through a blowpipe flame and adheres to the wall in a fused condition. Full details of the spray apparatus and the most suitable method of applying the slurry are given, as well as the desired characteristics of the cement. The wall must be red hot during the application. Method 2 was developed by the Institution of Gas Engineers. In method 3 doors are repaired by applying with a long-handled trowel a carefully compounded cement, which must set at 700°C. and must not melt at operating temperature. A dry cement consisting of 75% silica sand and 25% feldspar, mixed, sintered, and finely ground, with an addition of 1 to 2% lime as ground limestone, has been successfully applied by method 2 but is not true welding. The patch has a melting point of 1400° to 1450°C. Repairs of holes up to 4 ft. x 3 ft. x 4 in. deep have been carried out by this method. See "Hot. . .," *Ceram. Abs.*, **19** [6] 141–42 1940). L.R.B.

Plastic refractory mass K-N. M. Bindasov. *Amerik. Tekhnika*, **1940**, No. 9, pp. 471–72; *Khim. Referat. Zhur.*, **4** [7–8] 95 (1941).—B. describes a refractory material (K-N) used for open-hearth furnaces in the U. S. Its main components are Fe, Cr_2O_3, MgO, and water glass (7%). The advantages of this material over magnesite brick are discussed. M.Ho.

Production of alumina from refractory clays. S. V. Terpugov, A. M. Tiktina, and I. M. Danilova. *Izvest. Rostov. Nauch.-Issledovatel. Inst. Priklad. Khim.*, **4**, 44–57 (1940); *Khim. Referat. Zhur.*, **4** [9] 107 (1941).—The investigation was conducted with Sulin and Krasnogorsk clays. The former contained Al_2O_3 29.68 and Fe_2O_3 5.40%, and the latter contained Al_2O_3 33.53 and Fe_2O_3 3.00%. The optimum conditions for calcining were 650° for 1 hr. The Krasnogorsk clay, calcined at 650° and extracted with H_2SO_4, yielded an average of 91.31% Al_2O_3. When calcined at 850° it yielded 65.9 to 74.12%, and when calcined at 450° the yield was 65.33 to 74.61%. As steam

was used in the extraction with H_2SO_4, the acid used was 49 to 50° Bé. instead of 43 to 45° Bé. The acid solutions were neutralized with burned lime. When the solution cleared, it was filtered. Fe was reduced with metallic Al to FeO to prevent the precipitation of Fe_2O_3 when the $Al_2(SO_4)_3$ was crystallized. The crystallized-out $Al_2(SO_4)_3$ contained Al_2O_3 16, SO_3 37.64, H_2O 47.21, and Fe_2O_3 0.021%, giving 93.6% Al_2O_3 present in the crystallization solution. The optimum temperature for calcining $Al_2(SO_4)_3$ is 1000°. The resulting Al_2O_3 contained 0.15% SO_3. M.Ho.

Rational selection of refractories for lining mixers. I. SHVARTSMAN. *Ogneupory*, **1940**, No. 10, pp. 526–28; *Khim. Referat. Zhur.*, **4** [5] 89 (1941).—On the basis of a study of the service of refractories in a mixer of the Azovstal works, S. suggests the following selection of refractories for the various zones of a mixer. For lining the roof, the most suitable material is Dinas, but for the slag zone, magnesite is best. The central part of the pot, which is exposed to the stream of molten iron in casting, must be lined with magnesite, whereas the other parts are lined with grog. The spout is lined with magnesite. Grog or semiacid products are used for lining the taphole for molten iron. M.Ho.

Results attained in field of basic refractories for metallurgy. P. P. BUDNIKOV. *Visti Akad. Nauk Ukraïn. R.S.R.*, **1940**, No. 9, pp. 44–54; *Khim. Referat. Zhur.*, **4** [6] 96 (1941). M.Ho.

Rocklike mineral as grog substitute in the production of refractories. I. L. MOVSHEVICH. *Sbornik Materialov po Voprosu Ogneupornoi Prom.*, **1940**, No. 2, pp. 156–59; *Khim. Referat. Zhur.*, **4** [7–8] 95 (1941). M.Ho.

Special packing mass for repairing the melting zone of iron-smelting cupola furnaces. G. E. FREĬKMAN AND G. V. VASIL'CHENKO. *Ogneupory*, **1940**, No. 11–12, pp. 604–609; *Khim. Referat. Zhur.*, **4** [6] 97 (1941).—Results of experiments in replacing the grog lining of the melting zone of cupola furnaces with a packing of semiacid masses are given. The packing was prepared from 75 to 78 sand, 20 to 25 fire clay, and 1.5 to 2.5% water glass. The details of the preparation of this packing and its application are given, and the economic considerations are discussed. M.Ho.

Substituting fire clay with bentonite in foundry sand for steel casting. G. D. VASIL'EV. *Liteĭnoe Delo*, **1940**, No. 11–12, pp. 23–25; *Khim. Referat. Zhur.*, **4** [6] 97 (1941).—A molding sand containing bentonite was investigated first in the laboratory and then under plant conditions. The mix had the following composition: prepared soil 75.1, quartz sand 21.2, and a 35% bentonite suspension 3.6 or dry bentonite 1.27%. The use of the bentonite mix for steel casting eliminated the necessity of drying and painting the mold, sprinkling with a bonding material, and the use of kerosene. The use of the bentonite mix resulted in less work in the polishing department. M.Ho.

Thermostable magnesite refractories with a spinel mortar. A. S. BEREZHNOĬ AND V. M. TSYNKINA. *Sbornik Materialov po Voprosu Ogneupornoi Prom.*, **1940**, No. 2, pp. 38–102; *Khim. Referat. Zhur.*, **4** [9] 110–11 (1941).—Results of experiments show the possibility of producing high-quality thermostable refractories from Satkin magnesite. A study of the formation of various spinels at high temperature, primarily through reactions in the solid phase, showed that alumina and chrome spinels are the most suitable. A technological procedure is recommended based on the study of the interdependence between the properties of fired magnesite and the methods of its production. A review of the literature and a description of technological works are included. See "Production. . .," *Ceram. Abs.*, **18** [9] 245 (1939); "Spinel. . .," *ibid.*, **19** [3] 68 (1940). M.Ho.

Use of refractory concrete for lining the doors of coke ovens. A. A. PIROGOV AND V. A. NAĬCHUK. *Sbornik Materialov po Voprosu Ogneupornoi Prom.*, **1940**, No. 2, pp. 155–56; *Khim. Referat. Zhur.*, **4** [7–8] 95 (1941). M.Ho.

Wear of the lining of blast furnaces for bauxites. V. S. KVITKO. *Uralskaya Metallurgiya*, **1940**, No. 10, pp. 17–20; *Khim. Referat. Zhur.*, **4** [6] 96 (1941).—K. investigated the worn-out brick lining of a blast furnace. About 60 samples were studied. He concludes that the wear of furnaces working with bauxite is just about the same as that of furnaces smelting rich ore. The same lining may therefore be used in both. In the lower levels of the furnace the wear is very intense; consequently, the grog there should be replaced by corundum or a similar material. The slab and the lower part of the hearth can be lined with grog brick. M.Ho.

BOOKS

Manufacture of Grog Products. V. I. PEREVALOV AND A. A. KORSAKOV. Narkomugol S.S.S.R., Nauchnaya Biblioteka, Moscow, 1940. 20 pp. Price 0.5 R. Reviewed in *Khim. Referat. Zhur.*, **4** [6] 96 (1941).—An annotated list of books. M.Ho.

Production of Magnesite, Chromite, and Chrome-Magnesite Refractories. P. S. MAMYKIN. Metallurgizdat, Sverdlovsk and Moscow, 1940. 204 pp. Price 8.5 R. Reviewed in *Khim. Referat. Zhur.*, **4** [6] 96 (1941). See "Chromite. . .," *Ceram. Abs.*, **17** [2] 70 (1938). M.Ho.

PATENTS

Cast refractory. H. T. SMYTH (Corhart Refractories Co.). Can. 411,912, April 20, 1943 (July 11, 1941). G.M.H.

Extraction of aluminum oxide. F. SINGER AND L. BLASS. Brit. 552,583, April 29, 1943 (Sept. 19, 1941).

Furnace. JOSEPH KARMANOCKY (New Jersey Interlocking Brick Co.). U. S. 2,319,065, May 11, 1943 (Aug. 4, 1941).

Terra Cotta

For better building, nonmetal sink. ANON. *Architectural Record*, **88** [1] (1943).—A sink developed by the General Ceramics Co., Metuchen, N. J., is described. It is made of selected clays and fired at a high temperature. N.R.S.

SEPARATE PUBLICATION

Salt Glazes on Structural Clay Building Units. H. D. FOSTER. *Ohio State Univ. Eng. Expt. Sta. Bull.*, No. 113, 40 pp. (Nov., 1942).—Experimental glasses corresponding to glaze compositions in the Na_2O–Al_2O_3–SiO_2 system were made and studied. Commercial and laboratory glazes and modifications were next investigated, followed by glaze thickness, additions of borax and lithium, and tile-surface treatment. See *Jour. Amer. Ceram. Soc.*, **26** [2] 60–67 (Feb., 1942). W.D.F.

Whiteware

Ceramic cooking ware fills housewife's needs. PROBERT DAGER. *Ceram. Ind.*, **40** [2] 48–52 (1943).—Requirements for ceramic cooking ware are discussed, and four types of bodies, vitreous, semivitreous, fire-clay, and steatite, are outlined. 3 photos. H.T.

Components of aluminous insulators used in spark plugs. A. L. GERSHUNS. *Prom. Stroitel. Materialov*, **1941**, No. 3, pp. 27–30; *Khim. Referat. Zhur.*, **4** [9] 110 (1941). M.Ho.

Development of leadless glazes containing fluorides. PAUL M. CORBETT AND NORMAN J. KREIDL. *Ceram.*

Ind., **39** [2] 46–50; [3] 64–68 (1942).—Lead glazes have disadvantages not possessed by certain oxides and fluorides. Too high contents of alkali-metal oxides increase the coefficient of expansion to such an extent that crazing may occur. They can be used only for reducing rather than for replacing lead. The oxides of barium and strontium are suitable in conjunction with boric oxide. Zinc oxide has rather serious drawbacks, because it tends to crystallize out. The introduction of boric oxide is important in lead-free glazes. There is an ample supply of boric oxide in this country, but the European countries have shortages of both lead and boric oxides. Attempts to develop glazes free of both oxides led to the development of fluorine-containing glazes. Fluorides together with boric oxide yield glazes of low temperature coefficients and low melting points which are well adapted for whiteware and tile bodies. H.T.

Electroinsulating materials from bentonitic clays. Z. V. VOLKOVA. *Vestnik Elektroprom.*, **1941,** No. 2, p. 34; *Khim. Referat. Zhur.*, **4** [9] 110 (1941). M.Ho.

Glazes without lead. D. M. PANCHENKO. *Prom. Stroitel. Materialov*, **1941,** No. 2, pp. 33–34; *Khim. Referat. Zhur.*, **4** [9] 110 (1941).—Experiments were conducted on the composition of a leadless glaze with a melting point of 900° to 950°. Some samples contained a little borax and some were without it. The glazes were investigated for their spreading, adherence, resistance to leaching, color, and coefficient of expansion of the body and the glaze. Compositions of glazes which gave satisfactory results are given. The advisability of using glazes with small amounts of lead for various ceramic products is pointed out. M.Ho.

Insulator glazes. E. ROSENTHAL. *Elec. Rev.*; abstracted in *Nature*, **150** [3817] 771–72 (1942).—R. discusses the influence of insulator glazes on porcelain with particular reference to high-voltage insulators. Surfaces of unglazed ceramic materials show minute projecting peaks which make it evident that the quality of the surface has a bearing on the surface resistivity. This, in turn, is dependent on the humidity skin which increases with the surface roughness. High-temperature insulator glazes have a great influence on the surface resistivity as well as on mechanical and physical characteristics. The application of a suitable glaze increases not only the tensile strength but also other mechanical characteristics, such as compressive strength. Cap-and-pin, solid-core line, and station post insulators are designed to make use of the strengthening effect of glazes. See "Ceramic. . .," *Ceram. Abs.*, **22** [1] 13 (1943). G.A.K.

Low weight and high strength feature ceramic body. ANON. *Ceram. Ind.*, **39** [5] 62–66 (1942).—Trenton Potteries produce a lightweight ceramic body, called "Duraclay," which can be cast into large slabs up to 80 in. and bathtubs which weigh only 335 lb. The ware has exceptionally good heat-shock characteristics. 10 photos. H.T.

Physical properties of high-frequency electrical ceramic insulating parts. A. GUNZENHAUSER. *Ceram. Ind.*, **39** [5] 68–72 (1942).—Physical properties of ceramic electrical insulating materials are given and tabulated. 3 photos. H.T.

Porcelain proves best material for rubber glove forms. W. O. YOUNG. *Ceram. Ind.*, **40** [5] 72–74 (1943).—The Colonial Insulator Co. makes porcelain forms for rubber gloves. 4 photos. H.T.

Qualitative properties of the crude to be used in the projected plant for high-voltage porcelain in the Ural. M. M. KUZ'MIN. *Keram. Sbornik*, **1940,** No. 12, pp. 23–29; *Khim. Referat. Zhur.*, **4** [9] 110 (1941). See "Using. . .," *Ceram. Abs.*, **20** [9] 220 (1941). M.Ho.

Simplified use of triaxials aids in body control and development. ANON. *Ceram. Ind.*, **40** [4] 98–102 (1943).—Any type of whiteware body can be quickly developed if certain fundamental facts are known: (1) required properties, (2) clay combinations, taken from standard practice, (3) amount of clay, established against flint, for working properties, and (4) the amount of flux, determined by reducing the flint and increasing the feldspar to obtain proper vitrification. H.T.

Soluble sulfate content of pottery bodies during preparation. H. R. SHELL AND W. P. CORTELYOU. *Jour. Amer. Ceram. Soc.*, **26** [6] 179–85 (1943).—Three figures.

Thermal and moisture expansion of ball clays and bodies fired to different temperatures. H. THIEMECKE. *Jour. Amer. Ceram. Soc.*, **26** [6] 173–79 (1943).—6 figures, 4 references. See *ibid.*, **24** [2] 69–75 (1941).

PATENTS

Porcelain body production. E. H. FISCHER (Canadian Westinghouse Co., Ltd.). Can. 412,247, May 4, 1943 (July 25, 1941; in U. S. July 31, 1940). G.M.H.

Spark plug. R. F. LANDRUM (one-half to Eyvind Svendsen). U. S. 2,320,617, June 1, 1943 (May 12, 1941). C. M. CARINGTON (K. L. G. Sparking Plugs, Ltd.). U. S. 2,318,922, May 11, 1943 (Oct. 19, 1940).

Equipment and Apparatus

All-welded decal drying system saves over $3000 yearly. H. C. HEBENSTREIT. *Ceram. Ind.*, **40** [3] 50–52 (1943).—A decal drying system at the Royal China Co., Sebring, Ohio, speeds up production and reduces losses and floor space. 4 photos. H.T.

Analysis of dust by the Rebinder method. G. I. ROMASHOV AND M. V. GOLUBEVA. *Voprosy Ochistki Vozdukha ot Pyli. Sbornik Statei*, **1940,** pp. 40–44; *Khim. Referat. Zhur.*, **4** [9] 27 (1941).—Comparative results of the dispersion analysis of dust by the sedimentation method of Rebinder and by the air separation method are described. The two methods give widely differing results. M.Ho.

Beryllium windows. ZED J. ATLEE. *Gen. Elec. Rev.*, **46** [4] 233–38 (1943); abstracted in *Machinery* [N. Y.], **49** [8] 197 (1943).—The serious limitations of tubes with windows of Lindemann glass (containing boron, lithium, and beryllium in place of the silicon, sodium, and calcium of ordinary glass) have encouraged a search for better materials. Beryllium is ideal for use in windows of tubes transmitting long-wave X rays. The X-ray absorption of the pure metal is less than that of any other material used in diffraction tubes, with the exception of cellophane. The latter, however, can be used only when the tube is continually connected to the exhaust pumps. X-ray diffraction tubes of the permanently evacuated type and with beryllium windows are now available both for air and oil-immersed operation. These tubes have a better focal-spot design and have increased the tube speed as much as 15 times. 11 illustrations. L.E.T. + R.H.B.

Changes in standard Debye cameras for roentgenomineralogical investigation of soil and clay colloids. I. D. SEDLETSKIĬ. *Zavodskaya Lab.*, **9** [11–12] 1344–45 (1940); *Khim. Referat. Zhur.*, **4** [7–8] 37 (1941).—S. describes the changes made in the standard Debye cameras to produce the X-ray interference rings corresponding to $d \geq 20$ a.u. They permit the study of the roentgenographic and mineralogical composition of soil and clay colloids. M.Ho.

Coreless induction furnaces. M. J. MARCHBANKS AND H. I. WOOD. *Metropolitan-Vickers Gaz.*, **20** [337] 72–80 (1942).—Coreless induction furnaces up to 5-ton capacity for steel melting, casehardening, and annealing are described from the viewpoint of the electrical engineer. The performance, optimum frequency, and construction of the furnace, high-frequency generator, switch, and control gear are dealt with at length. Approximately 600 to 700 units of electricity are required to melt one ton of average high-class alloy steel in a hot furnace, but several factors affect this figure. L.R.B.

Crucible kryptol furnace. G. Ya. Pesenzon. *Zavodskaya Lab.*, **9** [11–12] 1345–47 (1940); *Khim. Referat. Zhur.*, **4** [5] 89 (1941).—A kryptol furnace constructed by P. is described. It has many advantages over the vertical tubular furnaces. The assembly and the operational data of the furnace are given. A temperature of 1580° is attainable in this furnace. M.Ho.

Dust as a dispersed system and methods for determining its composition. G. I. Romashov. *Voprosy Ochistki Vozdukha ot Pyli. Sbornik Statei*, **1940**, pp. 32–39; *Khim. Referat. Zhur.*, **4** [9] 27 (1941).—A brief review of ultramicroscopic, microscopic, sedimentation, dynamic, and other methods for the dispersion analysis of dust is given. M.Ho.

Effect of the medium on the efficiency of grinding in ball mills. V. I. Byalkovskiĭ and I. A. Kudinov. *Keram. Sbornik*, **1940**, No. 10, pp. 8–13; *Khim. Referat. Zhur.*, **4** [5] 114 (1941).—The factors which affect grinding in ball mills are (1) speed of the mill, (2) extent of filling the drum, (3) hardness and initial size of the charge, (4) medium in which the grinding is done, and (5) correlation between the various components of the ground material. The investigations of Rebinder explain the effect of the medium on the efficiency of grinding by physicochemical processes occurring on the surface of the dispersed material. The medium also affects the hardness of the material, for on it depends the stability of the product. The cohesiveness of the grinding medium also influences the efficiency of grinding. The resistance of a hard body to impact is determined by its elastic properties. The resistance to attrition depends on surface properties. The surface energy of solid bodies on the interphase is different for various media; consequently, the hardness of the same solid material in different media is different. The adsorption on an interphase leads to the formation of adsorbed layers, which in turn result in a decrease of hardness or an increased effectiveness of dispersion. Tables are given showing how the hardness of the same material (a ceramic color) varied as a function of the medium in which it was ground; when ground in air (dry grinding) the sclerometric hardness index was 1910, whereas in oleic acid it was 420. The effect of adsorbed layers on the hardness is illustrated with tables and diagrams. From these it is seen that surface-active substances added to the grinding medium lower the hardness of the ground material. The decrease in hardness also depends on the concentration of the adsorbent. Surface-active substances added in quantities of 0.1 to 1.0% form saturated adsorption layers which have the maximum effect in lowering the hardness. The influence of the relation between the components of the charge on the efficiency of grinding can be expressed by the following quantitative index: the maximum increase in efficiency is given by $w/s = 0.5$ to 0.6, where w is the weight of the liquid phase and s is the weight of the solid phase. This gives a concentration of the solid phase of approximately 70%. Maximum grinding is obtained when the following relation holds: $b/m = 1.6$ to 1.7, where b and m are the weight of the balls and the ground material, respectively. These conclusions were tested on a series of substances ground in clay cylinders and laboratory ball mills having a capacity of 10 liters. A table shows the effect of surface-active substances added to the dispersed phase. The efficiency of ball mills may be increased by increasing the load of balls, decreasing the amount of water, and adding surface-active substances. M.Ho.

Filter for removing dust in brickyards. A. M. Oshev and A. A. Sulkovskiĭ. *Otoplenie i Ventilyatsiya*, **1940**, No. 4, p. 19; *Khim. Referat. Zhur.*, **4** [9] 138 (1941). M.Ho.

Fifth Progress Report of the Welding Research Council. Anon. Abstracted in *Chem. Trade Jour.*, **111** [2880] 103 (1942).—The most important results of research in the five years prior to March, 1942, were as follows: (1) the problem of the weldability of low-alloy high-tensile steels has been elucidated. (2) Light has been thrown on the problem of the welding of high-tensile steels. (3) New information has been made available on the welding of copper and aluminum and its alloys and on the mechanism of fluxing. (4) It has been possible to raise the loading of welded rigid frameworks following a better knowledge of their plastic and elastic behavior. (5) A "Handbook of Welded Steel Structures" has been issued. (6) Problems in welding pressure pipe lines have been solved. (7) Information has been provided on the strength of spot welds in wrought aluminum alloys and in stainless steel, and technical memoranda on the spot welding of light alloys have been issued. In the last year high-temperature properties of weld metal between 850° and 1100°C. were studied. L.R.B.

Flotation and the size of particles: I. N. I. Birger. *Trudy Leningrad. Khim.-Tekh. Inst.*, **1940**, No. 9, pp. 242–45; *Khim. Referat. Zhur.*, **4** [9] 22 (1941).—It is known that emulsion flotation is most effective at a certain optimum size of the floated particles. The upper limit of this size is reached when the gravitational forces commence to preponderate over the wetting forces. The lower limit is determined by the removal of the particles from the interphase in consequence of Brownian movement. Departing from the principle of Van der Minne, i.e., considering the work connected with the transfer of particles across the interphase oil-water, B. derives a formula for calculating the maximum radius at which flotation is still applicable:

$$r_{max.} = \sqrt{\frac{3}{2}}\sqrt{\frac{\sigma^{1}/_{2}(1-\cos\theta)}{g(d-d_2)}},$$

where $\sigma^{1}/_{2}$ = surface tension on the interphase oil-water, $\cos\theta$ = cos of the angle, d = density of the particle, d_2 = density of water, and g = acceleration due to gravity. Taking into consideration the possibility of Brownian movement of the floated particles, B. derives a formula for determining the lower limit of flotation. For the special case where the two liquids are of the same specific gravity, this formula becomes

$$r_{min.} = \sqrt{\frac{1}{2}}\sqrt{\frac{\sigma^{1}/_{2}\,(1+\cos\theta)}{g(d-d_2)}}.$$

M.Ho.

Formula for calculating the length of a counter-current tunnel drier. A. V. Yaroshevskiĭ. *Prom. Stroitel. Materialov*, **1940**, No. 12, pp. 36–40; *Khim. Referat. Zhur.*, **4** [6] 130 (1941).—The length of a tunnel in meters is given by $L = \frac{k}{c-\lg w}$, where w = percentage of moisture evaporated from the green brick, and $c = 0.0243v(d_n - d_1) + 0.035$ (v = velocity of air in the tunnel, d_n = moisture content of the air entering the drier when saturated corresponding to the temperature to which it drops (in gm. per kgm.), and d_1 = moisture content of the air entering the drier (in gm. per kgm.)); k depends on c, and the relation is expressed by a formula. The equations given permit the calculation of the quantity of evaporated moisture for a given length of tunnel at given drying conditions, the length of the tunnel required to evaporate a given quantity of moisture, and the drying conditions required to remove a certain amount of water for a given length of the tunnel. See "Theory. . .," *Ceram. Abs.*, **20** [10] 242 (1941). M.Ho.

Increasing shovel output. Anon. *Excavating Engr.*, **37** [1] 24–26, 41 (1943).—The digging job can be analyzed and reduced to the smallest possible number of motions, with each motion as short as possible. Truck capacity should be an even multiple of actual dipper capacities. Use two-truck spotting if possible, so that one truck is being loaded while the other is getting in place. The trucks should be spotted so that the length of the body is along the arc of the dipper's swing and the loaded dipper comes in over the rear. Avoid the necessity of the truck juggling for position by employing a truck spotter or two boards nailed to form a right angle. The condition of the hauling road is important in expediting the haul. Avoid backing to dump; a bulldozer will help spread the material. A circular haul avoids a lot of

trouble. To save time at the shovel (1) dig as close to the bank as is safe; (2) move up when waiting for trucks; (3) loosen the material with the dipper while waiting; (4) clean up the pit as you go; (5) get a full dipper every pass; (6) do not start to swing with the dipper touching the bank; (7) always work for a balanced cycle; and (8) lay out the work so that natural drainage keeps the shovel on dry footing. W.D.F.

Machines for the fine-ceramic industry. FRIEDRICH LIPINSKI. *Keram. Rundschau*, **46** [37] 430–39 (1938); see *Ceram. Abs.*, **19** [10] 240 (1940). M.V.C.

Metron four-range electric comparator gauge. ANON. *Machinery* [N.Y.], **49** [8] 228 (1943).—An electric comparator gauge of the four-range precision measuring instrument type, designed for the rapid comparison of close-tolerance machine parts, selective sorting of machine parts, measuring taper and out-of-roundness, and measuring shop tools and gauges to determine accuracy and wear, has been brought out by the Metron Instrument Co., Denver, Colo. R.H.B.

***Modern driers.** E. GLÜCKLICH. *Feuerungstechnik*, **30** [3] 57–62 (1942).—Reasons for drying materials in different industries are discussed, and processes and apparatus are described. M.HA.

***New method of examination of surface structures: radiography and microradiography by reflection.** J.-J. TRILLAT. *Compt. Rend.*, **214** [4] 164–66 (1942).—To obtain a radiogram of a surface, not the incident X rays but the photoelectrons emitted under the impact of the X rays are utilized. If the surface is extended enough (several square centimeters) the macromethod gives sufficiently clear results, but for smaller surfaces of a few square millimeters a special film (Lippmann) is used to obtain enlarged pictures. See "Reflection. . .," this page. M.HA.

New types of driers in the ceramic industry. M. F. ZONNENBERG AND S. A. DAMASKIN. *Prom. Stroitel. Materialov*, **1940**, No. 12, pp. 33–36; *Khim. Referat. Zhur.*, **4** [6] 129–30 (1941).—Experiments were made on drying brick in an experimental drier built on the principles of the Odel'skiĭ drier. The water vapor condenses on the cold walls (made of glass), is drained off through cracks in the walls, and is collected in draining troughs. The drying was conducted at an external temperature of 5° to 7°. Two upright partitions separated the drying zone from the zone of condensation; between the two zones was a difference of 30°. The time of drying was 58 hr. with an almost complete absence of culls; 113 kgm. of fuel were required for 1000 normal brick. The low cost of the drier, the low fuel consumption, the absence of mechanical energy, and the fast and even high-grade drying make this a very desirable type of drier. Its possibilities should be tested under plant conditions. M.HO.

Pipette method of size analysis for the centrifuge. STEPHEN W. DANA. *Jour. Sediment. Petrol.*, **13** [1] 21–27 (1943).—An equation is derived which gives the relation between the time required for sedimentary particles to settle out a specified distance in the tube of a microcentrifuge and the radius of the particles. This is done by substituting in Stokes' law the centrifugal force concerned for the gravitational force incurred by particles falling through free water. Results obtained experimentally by the pipette-centrifuge method check closely with those obtained by ordinary pipette procedure and are obtained much more quickly. A complete procedure is presented. The method applies to grades below $^1/_{256}$ mm. G.M.H.

*Obtained from microfilm.

***Reflection radiography.** A. GUINIER AND J. DEVAUX. *Compt. Rend.*, **214** [5] 223–25 (1942).—The authors describe a modification of the Trillat method (see "New. . .," this page) which consists in applying a reinforcing layer and using incident rays of varying wave length; this improves the identification of elements in the surface. M.HA.

Sphericity determinations of pebbles and sand grains. WILLARD D. PYE AND MARGARET HURST PYE. *Jour. Sediment. Petrol.*, **13** [1] 28–34 (1943).—Sphericity is determined simply by taking the ratios of the diameters of the particles. The method given shows yields essentially the same as those of Wadell. G.M.H.

BOOK

Air Conditioning Analysis. WILLIAM GOODMAN. Macmillan Co., New York, 1943. 455 pp., 158 pp. of tables, and 7 psychrometric charts, including the water-air chart. Price $6.00.—This is the first book to give a comprehensive and unified treatment of the fundamental science underlying all aspects of air conditioning and its many industrial uses. The complete psychrometric tables and charts, the inclusion of much material of direct practical value to the air-conditioning engineer, and the practical viewpoint of the experienced engineer which is evident throughout the book make this a highly useful handbook for anyone in the air-conditioning industry as well as an important basic text for engineering students.

PATENTS

Abrading apparatus. W. L. KEEFER (Pangborn Corp.). U. S. 2,320,364, June 1, 1943 (March 19, 1940).

Apparatus for determining the total specific surface or the particle-size distribution of powdered materials. H. HEYWOOD. Brit. 552,398, April 21, 1943 (Oct. 2, 1941).

Apparatus for gravity separation of granular material. A. A. HIRST (one-half to Simon-Carves, Ltd.). U. S. 2,320,519, June 1, 1943 (Jan. 7, 1941).

Drying of porous masses. D. W. ROSS. U. S. 2,320,474, June 1, 1943 (Sept. 9, 1941).—The method of drying uniformly and without casehardening a ceramic body that in the condition of a water-filled plastic has been molded to shape, which consists in including in the ceramic mix, in addition to the mixing water, another electric-conductivity-increasing ingredient, bringing the still wet body within an envelope of water-dissipating character, and causing electric current to flow through an interior portion of the body and in so doing to heat the interior portion to a higher temperature than that of the surface, whereby the flow of water from the interior to the surface is expedited.

Electrostatic cement raw material separation. THORBJORN HEILMANN (F. L. Smith & Co.). Can. 411,952, April 20, 1943 (Dec. 12, 1940). G.M.H.

High-temperature retort. E. A. LERNER (American Brake Shoe & Foundry Co.). Can. 411,879, April 20, 1943 (Aug. 15, 1941). G.M.H.

Hydropneumatic press. D. E. GRAY (Corning Glass Works). Can. 412,261, May 4, 1943 (July 24, 1941; in U. S. Aug. 27, 1940). G.M.H.

Induction furnace. J. R. WYATT (Ajax Electric Furnace Corp.). U. S. 2,320,692, June 1, 1943 (Sept. 19, 1941).

Refractometer. H. W. STRAAT (Bausch & Lomb Optical Co.). U. S. 2,319,889, May 25, 1943 (July 5, 1941).

Spray nozzle. D. J. PEEPS (DeVilbiss Co.). Can. 412,265, May 4, 1943 (May 14, 1942; in U. S. May 15, 1941). G.M.H.

Kilns, Furnaces, Fuels, and Combustion

***Climatization of combustion air. Means for increasing the capacity and economy of stoking.** W. GUMZ. *Feuerungstechnik*, **30** [1] 1–4 (1942).—To improve combustion G. proposes, contrary to present usage, to control only the amount and temperature of the combustion air in each combustion zone and to take into account the saturation of the air. This would save the grates (avoid rusting), reduce difficulties due to slag (especially for low fusion

point ash), and result in better utilization of the combustion chamber. Secondary air is supplied above the grate. M.HA.

***Combustion experiments with bituminous coal briquettes briquetted without binders in a zoned traveling grate.** E. RAMMLER. *Feuerungstechnik*, **30** [3] 49–52 (1942).—The experiments showed that binderless briquettes, simply compressed under high pressure from coal dust of highly volatile bituminous coal, can be successfully burned on a traveling grate and that they burn very uniformly. The formation of fly ash is not greater than with other briquettes for normal grate capacities up to about 1.2×10^6 Cal./m.^{2} hr. and becomes appreciable only for high grate loading at about 1.8×10^6 Cal./m.^{2} hr. M.HA.

Effect of kiln gases in glost firing of ware. JOHN H. KOENIG. *Ohio State Univ. Eng. Expt. Sta. News*, **15** [1] 13–23 (1943).—K. reviews this subject. 89 references. W.D.F.

***Formulas for calculating the quantitative composition of a mixture of two fuel gases from the CO_2 and O_2 content in the waste gas.** E. VON CASTELL. *Feuerungstechnik*, **30** [4] 84–86 (1942).—To facilitate the determination of the required mixture of two fuel gases of widely differing heat values, formulas are developed from the analysis of the combustion gases of the mixture for combustion with the theoretical amount of air and with excess air. From these formulas, a diagram is made to determine the amount of excess air from the CO_2 content in the waste gas for different percentages of the gas with the lower heating value in the mixture. M.HA.

***Methods for determining the caking ability of coals.** P. HOFFMANN. *Feuerungstechnik*, **30** [3] 52–57 (1942).—Caking ability is defined as the tendency of certain bituminous coals to fuse, soften, and form lumpy coke when heated to high temperatures. The various methods of determining caking ability are discussed; the usual method consists in mixing the coal with sea sand or other addition and determining the caking ability indirectly by determining the binding ability with the sand. Standardized methods in France, Great Britain, and America are described. 34 references. M.HA.

Return recuperative electric kiln utilizes all heat input. ANON. *Ceram. Ind.*, **40** [2] 43–46 (1943).—An electric decorating kiln of unique construction has been in operation for 5 years at the plant of the Hall China Co., East Liverpool, Ohio. It is a straight kiln but is closed at one end. It has two decks or levels of operation. The ware enters the upper deck, is fired at the closed end of the kiln, and returns on the lower deck. Nichrome heating elements are used. The daily capacity is 1400 dozen pieces. 3 photos, 1 chart. H.T.

Stokers do good job in firing electrical porcelain ware. ANON. *Ceram. Ind.*, **39** [2] 52–54 (1942).—The electrical porcelain plant of the Square D Co., Peru, Ind., averages 27 tons of ware daily, using 3 to 4 tons of coal. 2 photos, 1 chart. H.T.

Storage of coal used for intermittent kilns. H. F. HOLGATE. *Claycraft*, **16** [7] 241–46 (1943).—Because of uncertainties in coal supplies, many brickworks find it necessary to carry large reserve stocks which are frequently stored on open ground. H. describes experiments made to determine the effects of such storage by results obtained in firing refractory materials, particularly with regard to coal consumption and temperature rise. All observations were made on a bituminous bright hard coal, large stocks of which were carried for varying periods. The kilns were of the intermittent downdraft type, firing ware requiring finishing temperatures of 1400° to 1450°C. Results are shown by plotting temperature rise against time. The data presented show that (1) the use of stored coal often results in increased coal consumption and greater difficulty in obtaining satisfactory rates of temperature rise between 1250°C. and maximum heat; and (2) as coal was usually dumped so that the first loads dumped were likely to be the last used, the above effects were more definite when coal was being brought from almost demolished heaps. Conclusions are as follows: (1) As far as possible coal should be stored on hard flat surfaces, preferably concrete. (2) Dumps should be arranged so that any one load of coal is not stored for too long a period. (3) If any stored coal is found to have deteriorated, its use should be confined as far as possible to firing stages up to 1250°C. G.A.K.

***Thermodynamic calculation of combustion temperatures and reactions in gas mixtures under strictest consideration of all dissociation possibilities: III.** H. ZEISE. *Feuerungstechnik*, **30** [2] 25–29 (1942).—On the basis of more recent investigations of gasification problems by Traustel, Gumz (see "Climatization. . .," page 122), and Fehling, the possible reactions in the combustion process, in particular "simultaneous dissociations," are discussed physically and mathematically, and formulas for them are derived. Besides the reactions $[C] + O_2 = CO_2$, $2[C] + O_2 = 2CO$, $\frac{1}{2}[C] + H_2O = \frac{1}{2}CO_2 + H_2$, and $CO_2 + H_2 = CO + H_2O$, the reactions $[C] + H_2O = CO + H_2$, $[C] + 2H_2O = CO_2 + 2H_2$, $[C] + CO_2 = 2CO$, and $CO + H_2O = CO_2 + H_2$ are also considered important, especially in calculating high combustion temperatures. 18 references. M.HA.

* Obtained from microfilm.

BOOK

Fuel Testing: Laboratory Methods in Fuel Technology. GODFREY W. HIMUS. Leonard Hill, Ltd., London, 1942. 288 pp. Price 21s. Reviewed in *Coke & Smokeless-Fuel Age*, **5** [44] 4 (1943).—This volume incorporates the improvements in analytical methods, the outcome mainly of the work of the British Standards Inst. and the Fuel Research Board since 1932, when the first edition appeared. L.R.B.

PATENTS

Electrical systems for the automatic control of temperature. BRITISH THOMSON-HOUSTON CO., LTD. Brit. 552,094, April 7, 1943 (Sept. 18, 1940).

Siliconized silicon carbide connection and method of making. A. H. HEYROTH (Carborundum Co.). U. S. 2,319,323, May 18, 1943 (June 8, 1938).—A compound resistor comprising a plurality of bodies of predetermined size and contour composed principally of recrystallized silicon carbide and integrally united by means of welds containing silicon admixed with silicon carbide.

Tunnel kiln. F. W. BROOKE AND P. H. DRESSLER (Swindell-Dressler Corp.). U. S. 2,320,172, May 25, 1943 (June 19, 1939).—A continuous tunnel kiln comprising two side-by-side goods pathways and a walking beam at the bottom of each pathway adapted to move goods along that pathway in a direction opposite to that in which the other beam moves goods along the other pathway and having transverse passages through its central portion and kiln-heating means adapted to maintain temperatures substantially higher in the central section of the kiln than in its end sections comprising a set of transverse stationary electrical heating elements extending through the transverse passage.

Geology

Application of principles of soil mechanics to rolled-fill earth dams. D. F. GLYNN. *Jour. Inst. Engrs. Australia*, **14** [6] 139–46 (1942).—G. discusses U. S. Bureau of Reclamation methods in the control of rolled-fill earth dam materials during construction as applied in practice in Australia. L.R.B.

Arkansas travelogue. EVAN JUST. *Eng. Mining Jour.*, **144** [1] 46–49 (1943).—The Batesville manganese ores are composed to a lesser extent of carbonate replacing limestone, which weathers to give the more important wad ores. The ore bodies are small, thin, and irregular, and the mining methods are crude. Prospecting is done by

test pit or churn drills. No attempts have been made to use geophysical methods. Zinc and lead are mined in northern Arkansas. The number of mines and prospects is amazing when compared to their small aggregate output. The mines use gravity methods to separate sphalerite from limestone, chert, quartz, and calcite. The ore deposits are in the Cotter and Powell dolomites and Everton limestone of Ordovician age and the Boone formation (Mississippian). The primary ore minerals are sphalerite and galena, and the principal oxide minerals are smithsonite and calamine. The principal output has been oxidized ores, for which there has been an indifferent market; the war demand, however, should change this. W.D.F.

Australian alunite. ANON. *Chem. Trade Jour.*, **111** [2877] 38 (1942).—There are five alunite deposits in South Australia. At one of these near Port Pirie, adequate transport facilities are available, according to a report of the South Australian Chemical Inst. L.R.B.

Barytes, a nonmetallic product of eastern Tennessee. A. H. HUBBELL. *Eng. Mining Jour.*, **144** [1] 63–65 (1943).—Residual surface clays from the weathering of the Knox dolomite are mined for their barite content. The L. A. Wood Co. has six mines in the Sweetwater district and is the principal producer in Tennessee. At the Stephens mine, a $^3/_4$-yd. shovel loads two trucks. The trucks dump in a 4-in. grizzly, where dirt is washed through by a stream of water into a 27-ft. double log washer; the overflow goes to waste. The product passes a trommel with a $1^1/_4$-in. hole. The trommel oversize is shipped if clean; otherwise, it is crushed and jigged. Trommel undersize is jigged in a four-cell set. The cup product is cleaned of iron on a picking belt, the hutch products are tabled, and the tails go to waste. See "New. . .," *Ceram. Abs.*, **22** [2] 38 (1943). W.D.F.

Bauxite in Nyasaland. G. HALL. *Chem. Trade Jour.*, **109** [2840] 200 (1941).—No concession to exploit bauxite in the Mlaye Mountain in Nyasaland has been granted to the Anglo-American Corp. of South Africa, but this firm has an exclusive prospecting license over areas in this district. L.R.B.

Bauxite in South India. ANON. *Times*, No. 49,353, p. 4 (1942); *Chem. Trade Jour.*, **111** [2889] 300 (1942).—Important deposits of high-grade bauxite have been discovered in the Shevaroy Hills by the Geological Survey of India. See "Bauxite. . .," *Ceram. Abs.*, **21** [5] 102 (1942). A.B.S. + L.R.B.

Brazilian bauxite. ANON. *Chem. Trade Jour.*, **112** [2905] 84 (1943).—120 million tons of bauxite are available on the Poços de Caldas plateau in Minas Geraes; 10% of the available supplies show 60 to 65% Al_2O_3. See *Ceram. Abs.*, **19** [9] 221 (1940). L.R.B.

Canadian magnesite. ANON. *Chem. Trade Jour.*, **109** [2838] 176 (1941).—The magnesite deposits in the Province of British Columbia average 40% magnesia. Developments are on foot in the east Kootenay area. L.R.B.

Contributions to the theory of the basic properties of clay solutions used in oil drilling and the structure formation in these solutions. P. A. REBINDER, N. N. SERBSERBINA, AND S. A. NIKITINA. *Nauch. Issledovatel. Raboty Khim. Inst. i Lab. Akad. Nauk S.S.S.R. za 1940*, **1941**, pp. 127–28; *Khim. Referat. Zhur.*, **4** [9] 23 (1941). M.Ho.

Effect of salt solutions on the stability of suspensions of Chasov-Yar clay No. 5 and Palansk kaolin. S. N. KUZ'MENKO. *Byull. Khim. Obshchestva Mendeleeva*, **1940**, No. 11, pp. 11–12; *Khim. Referat. Zhur.*, **4** [7–8] 94 (1941). M.Ho.

Graphical representation of calciferous amphiboles. A. F. HALLIMOND. *Amer. Mineralogist*, **28**, 65–89 (1943).—A series of 196 amphibole analyses have been calculated to atomic ratios according to the standard structural formula $(Ca,Na)_2Na_{1-2}(Mg,Al)_5(Si,Al)_8O_{22}(OH,F)_2$, attention being confined to those with Ca > 1.5 atoms to the unit cell. There is a well-defined upper limit at Ca = 2 atoms and a fairly sharp lower limit to Si at 6 atoms. The analyses are represented on a triangular diagram having as coordinates (*a*) the number of atoms of Si and (*b*) the number of alkali atoms allotted to the vacant space. Nearly all of the present minerals can be derived from tremolite by two substitutions, Al_4/Si_2Mg_2 and Na_2Al_2/Si_2, while a third substitution, NaAl/CaMg, would give rise to glaucophane-like minerals not included in the present list. There is shown to be a general relationship between the type of amphibole and the nature of the parent rock. Values are given for the volume of the unit cell containing 24 O; they are very uniform, increasing a little toward hastingsite. Work on basaltic hornblende is briefly summarized. W.D.F.

Identification of opaque minerals by electrochemical methods. DANIEL V. DODGE. *Amer. Mineralogist*, **28**, 103–109 (1943).—A relatively large group of species fail to react with the etching reagents which are used in the standard methods of identification of opaque minerals. This group may be subdivided by inserting two electrodes in a drop of etch reagent on a polished surface of the mineral and electrolyzing. The results obtained with electrolyzation by means of both alternating and direct currents are presented. W.D.F.

Introduction to Cretaceous of California. OLAF P. JENKINS. *Bull. Amer. Assn. Petroleum Geologists*, **27** [3] 249–61 (1943).—A list of Cretaceous units of the State is presented, and the distribution is shown by map. General thicknesses are indicated. Cretaceous economic products are building stone, gold, oil, and gas. G.M.H.

Kinetics of coagulation processes and the growth of particles in a sol. O. M. TODES. *Nauch. Issledovatel. Raboty Khim. Inst. i Lab. Akad. Nauk S.S.S.R. za 1940*, **1941**, pp. 120–21; *Khim. Referat. Zhur.*, **4** [9] 24 (1941). M.Ho.

Large and small garnets from Fort Wrangell, Alaska. A. PABST. *Amer. Mineralogist*, **28**, 233–45 (1943).—Measurement of 133 garnets from Fort Wrangell, Alaska, shows conclusively that there is excellent correlation of habit with size. These garnets all show both (110) and (211). The larger the garnet, the more pronounced is (110). The distance between opposite faces of the same form is made perpendicular to a trigonal axis, and the measurements for each form are averaged separately. Let D_{110} and D_{211} be these mean differences; then the habit ratio, H, is D_{110}/D_{211}. The mean value of H is 1.0063, and $H = 1.1336 - 0.0746\ D_{211}$, the equation being fitted by least squares. A malformation measure, M, is obtained by multiplying the average difference of the actual faces and the average by 100 and dividing by the average. This value ranges from 1 to 6. W.D.F.

Later igneous rocks of Arvon. EDWARD GREENLY. *Geol. Mag.*, **79**, 328–31 (1942).—Paleozoic intrusions include more dikes than sills. The sills are diabase. The dikes contain dolerite and andesite. The minerals are seldom fresh, and olivine is unknown. Neozoic intrusions have fresh minerals and have produced some thermometamorphism. W.D.F.

Lembergite and compounds similar to it. A. E. LAGORIO. *Izvest. Sektora Fiz.-Khim. Anal. Inst. Obshcheĭ Neorg. Khim.*, **13**, 407–408 (1940); *Khim. Referat. Zhur.*, **4** [7–8] 38 (1941).—L. studied the crystallographic and optical properties of a series of analcites and leucites synthesized by Lemberg. The study revealed that the acid analcites as well as the normal ones are isotropic in their perfectly crystallized cubes and icositetrahedra; at times, however, they display an anomalous double refraction. L. studied a silicate of the composition $5Na_2Al_2Si_2O_8 + 4H_2O$ called by Lemberg "nepheline hydrate." It crystallizes in a rhombic system and appears as (110), (001), and (010). The angle (110) (010) = 112°; the angle (001) (010) = 90°. The crystals are prismatic and attain a length of 0.5 mm. The average index of refraction is 1.57. Heating to 80° does not affect the crystal; heating to 115° changes the optical mark to a negative. Heating to a dull red causes the crystals to disintegrate into small prisms. Material heated to 115° is capable of reabsorbing water and returning to its original state. According to L., this silicate is doubtlessly found in nature and should play an important role in metamorphic and decomposition processes. The mineral

appears to be a separate species unlike any of the known zeolites, and L. suggests for it the name "lembergite." M.Ho.

Lithium ores in South-West Africa. ANON. *Chem. Trade Jour.*, **109** [2837] 158 (1941).—The lithium minerals amblygonite and lepidolite, containing, respectively, 4 and 8.5% of Li_2O, are mined by the Jooste Lithium Mines, Ltd., at Karibib. The reserves of the former mineral seem to be limited. L.R.B.

Method for determining the sign and magnitude of the electrokinetic potential. S. N. ALESHIN. *Kolloid. Zhur.*, **6** [8] 701–704 (1940); *Khim. Referat. Zhur.*, **4** [9] 24 (1941).—A. describes a new adaptation of the Gortikov apparatus for studying the electroosmosis of soil suspensions and gels. The diaphragms were produced by centrifuging, sedimentation, or gelling of sols. M.Ho.

Mining and washing kaolin in western North Carolina. A. H. HUBBELL. *Eng. Mining Jour.*, **144** [1] 51–53 (1943). The Harris Clay Co. owns three mines and leases two others in Mitchell and Avery Counties in North Carolina. At the Sparks mine a shovel loads trucks; at the mill the clay is dispersed in water and blunged. A 24-ft. hydroseparator is used, and its overflow is the finished clay which then goes to settling tanks. Mica is recovered by flotation from the hydroseparator underflow; this is used for roofing. The Carolina China Clay Co. also has a kaolin mine in Mitchell County. The mining is done hydraulically; the suspension is elevated by a bucket elevator to a flume which takes it to the clay plant. It goes through a sand wheel classifier and then through two blungers, a second sand wheel classifier which separates out the coarse sand and mica, and a settling tank, where fine sand and mica are caught. The mica is separated by means of jigs. See "Kaolin. . .," *Ceram. Abs.*, **20** [11] 270 (1941). W.D.F.

Nonfreezing clay solutions. P. I. DENISOV. *Azerbaĭdzhanskoe Neftyanoe Khoz.*, **1941,** No. 1, pp. 31–32; *Khim. Referat. Zhur.*, **4** [9] 110 (1941).—The preparation of nonfreezing clay solutions in water with the addition of salts greatly enhances the stability of the solution. In the laboratory investigating the preparation of nonfreezing clay solutions, the waters from Kara-Chukhur wells were also tested. The nonfreezing suspensions were prepared with well water, sea water, and their mixtures. To make a clay suspension nonfreezing at 10°, D. recommends well and sea water in the ratio of 50:50 or 25:75. M.Ho.

Phase analysis and its application for the investigation of apatite-nepheline minerals. A. I. VOLODCHENKOVA AND B. N. MELENT'EV. *Izvest. Akad. Nauk S.S.S.R., Ser. Geol.*, **1941,** No. 1, pp. 141–50; *Khim. Referat. Zhur.*, **4** [9] 41–42 (1941).—The authors propose two methods for a quantitative mineralogical analysis of apatite-nepheline minerals containing, as the main components, nepheline, apatite, dark-colored components, feldspars, sphene, titanomagnetites, and ilmenite: the separation of components by differentiating them according to specific gravity and subsequently dissolving some of them in solutions of HNO_3 of various concentrations, followed by magnetic or electromagnetic separation. Tried on synthetic mixtures of these minerals, the phase analysis showed its applicability for this purpose. The method was also tried on commercial products. Calculating the total alumina content in the nepheline concentrate from the content in the separate components and the amount of the latter as determined by this method gives somewhat lower results (approximately 1%) compared with the total chemical analysis. The authors believe this is caused by drawbacks in the analytical methods. The adaptability of the method of phase analysis for liparite ores is shown, and the results of quantitative mineralogical analysis of apatite-nepheline ores extracted in Khibiny in 1938 are given. M.Ho.

Preparation and study of properties of a primary dispersion of Ca clay. V. S. SHAROV AND V. A. BUTOVSKAYA. *Kolloid. Zhur.*, **6** [7] 587–96 (1940); *Khim. Referat. Zhur.*, **4** [6] 95 (1941).—The authors used 1% suspensions of Na and Ca Kudinov clays. Two series of suspensions were made, one prepared by the usual method and the other from a clay paste. The dispersibility of the Na clay was the same, regardless of the method of making the suspension. In the case of the Ca clay, the dispersibility was greater when the suspension was prepared from the paste. From this, the authors conclude that the trituration does not change the primary dispersibility of the Na-clay particles, whereas in the Ca clay the secondary particles are completely decomposed into primary particles. The results further point to the fact that by triturating puddled soil saturated with bivalent cations it is possible to produce a suspension of the same degree of dispersion as that from a Na soil. Such a suspension retains the properties of a primary suspension, and upon standing there is no aggregation of primary particles into secondary particles. M.Ho.

Present status and prospects for development of sources for lime fluxes in the Urals. V. E. SHNEĬDER AND YU. L. CHERNOSVITOV. *Gornyĭ Zhur.*, **1940,** No. 12, pp. 28–32; *Khim. Referat. Zhur.*, **4** [5] 89 (1941). M.Ho.

Recent methods of investigating the stability of earth slopes. A. R. OLIVER. *Jour. Inst. Engrs. Australia*, **14** [10] 235–41 (1942).—Dams are frequently made of earth (considered as any material between the limits of colloidal clay and gravel) resting on earth. This material in practice has variable properties on one site, and rigid calculations cannot be made. From the engineer's standpoint important properties are density (including porosity and water content), angle of internal friction, and cohesion, the last being best measured by filling the Krey shear box and pulling opposite halves apart. Different methods of evaluating the stability of earth slopes by graphical analysis are considered in which the methods used by the South Australian Harbours Board are followed. This is an adaptation of the sliding-circle method of the Swedish Geotechnical Commission to which the forces due to water in the soil have been added. Reference is made to Terzaghi's graphoanalytical method and a modification by Chugaev and to analytical methods. L.R.B.

Settling of heavy minerals in a granodiorite dike at Bradford, R. I. ALONZO QUINN. *Amer. Mineralogist*, **28,** 272–81 (1943).—The dike is just south of Bradford and is 65 ft. thick. The proportion of heavy minerals increases systematically toward the base of the dike. This is due to crystal settling, as (1) the minerals are heavier than the magma; (2) they crystallize early; (3) they settle mostly into depressions in the floor; and (4) hydrothermal action would be at the top of the dike. The following heavy minerals were found in significant amounts: magnetite, biotite, allanite, muscovite, zircon, sphene, and apatite. W.D.F.

South African magnesite. ANON. *Mem. S. African Geol. Survey*, No. 38; *S. African Mining & Eng. Jour.*, Oct. 17, 1942; abstracted in *Chem. Trade Jour.*, **111** [2898] 502 (1942). L.R.B.

Standard of Cretaceous system. SIEMON WM. MULLER AND HUBERT G. SCHENCK. *Bull. Amer. Assn. Petroleum Geologists*, **27** [3] 262–78 (1943).—A composite Cretaceous time-rock column has been built up by combining continuous sections which are well exposed in Europe. Division into series, stages, and zones is based on paleontological evidence without regard to thicknesses or lithology. G.M.H.

Study of Ural dunites from the viewpoint of their utilization in industry. N. V. BUTYRIN AND A. A. IVANOV. *Nauch. Issledovatel. Raboty Khim. Inst. i Lab. Akad. Nauk S.S.S.R. za 1940*, **1941,** pp. 182–83; *Khim. Referat. Zhur.*, **4** [9] 111 (1941). See "Complex. . .," *Ceram. Abs.*, **22** [1] 18 (1943). M.Ho.

Upper Cretaceous stratigraphy of west side of Sacramento Valley south of Willows, Glenn County, Calif. J. M. KIRBY. *Bull. Amer. Assn. Petroleum Geologists*, **27** [3] 279–305 (1943). G.M.H.

Venezuelan asbestos discovery. ANON. *Chem. Trade Jour.*, **112** [2904] 61; [2906] 105 (1943).—Cross-fiber veins of asbestos discovered near Tinaquillo in the State

of Cojedes, Venezuela, are being developed in cooperation with the U. S. Bureau of Mines. L.R.B.

X-ray petrology of some fine-grained foliated rocks. H. W FAIRBAIRN. *Amer. Mineralogist*, **28**, 246–56 (1943).—Thin plates of rock cut perpendicular to the foliation of slate and shale were examined by means of an X-ray beam perpendicular to the plates. Conclusions are as follows: (1) A definite relation exists between the angular spread of the reflections from the oriented platy minerals and the cleavability of the rock; the smaller the spread, the better is the foliation. (2) Greater angular spread of reflections from platy minerals results when the X radiation is parallel to the lineation than when it is perpendicular to it. No lineation was discovered by X-ray analysis which was not easily visible in the specimen concerned. (3) Parting of shale is explained in the same manner as foliation in schists, i.e., by parallel orientation of platy minerals. (4) Supplementary optic examination of quartz in one of the rocks gives a typical girdle orientation of the axes, although random orientation is indicated from its X-ray photograph. (5) The methods employed thus far permit subdivision of the platy minerals into a kaolinite-chlorite group and a muscovite-illite group (white mica). Their relative proportions can be estimated by inspection of the chief reflection rings of each group. (6) In the slates examined, white mica is greater than kaolinite-chlorite where cleavability is high; kaolinite-chlorite exceeds white mica where cleavability is low. W.D.F.

BOOKS

Nonmetallic Minerals in U.S.S.R.: Vol. 4. Edited by A. E. FERSMAN. Akad. Nauk S.S.S.R., Moscow and Leningrad, 1941. 772 pp. Price 47.50 R. Reviewed in *Khim. Referat. Zhur.*, **4** [9] 41 (1941).—Clays and kaolins, together with bleaching clays, are included. M.Ho.

Roentgenographic Tables for Identifying Minerals in Soil Colloids. I. D. SEDLETSKIĬ. Edited by I. N. Antipov-Karataev. Akad. Nauk S.S.S.R., Moscow and Leningrad, 1941. 42 pp. Price 3.70 R. Reviewed in *Khim. Referat. Zhur.*, **4** [7–8] 57 (1941). M.Ho.

Chemistry and Physics

Concentration methods in spectrographic analysis: I, Recovery of cobalt, nickel, molybdenum, copper, and zinc from plant materials and soil extracts by 8-hydroxyquinoline. R. O. SCOTT AND R. L. MITCHELL. *Jour. Soc. Chem. Ind.* [London], **62** [1] 4–8 (1943).—Trace elements in soils, etc., may be concentrated 500 fold by precipitation with 8-hydroxyquinoline. Iron is also precipitated and is used as a reference substance, being determined colorimetrically and spectrographically. Quantitative recovery is shown for amounts of Ni, Co, and Mo down to 0.001 mgm. and of Cu and Zn down to 0.4 mgm. L.R.B.

Need for reform in inorganic chemical nomenclature. JANET D. SCOTT. *Chem. Rev.*, **32**, 73–97 (1943).—Lack of conformity of usage with formulated systems of inorganic nomenclature is discussed. Difficulties are encountered in indicating the proportions of constituents of compounds (either by valence or by stoichiometric composition), in varying usage of prefixes and suffixes, and in differences in the order of designating constituents. S. points out nomenclature problems relating to (1) elements, (2) groups such as alkaline earths and halides, (3) radicals or ions, and (4) certain classes of compounds. The classes considered are intermetallic compounds, oxygen acids, salts (including acid and basic salts, double or multiple salts as contrasted with complexes and molecular addition compounds, and salts with mixed halogen anions), molecular addition compounds (such as hydrates and ammoniates), coordination compounds, and isopoly and heteropoly acids and their salts. Examples of miscellaneous compounds are also presented. W.D.F.

New data on changes of kaolin upon heating. B. S. SHVETSOV AND KH. O. GEVORKYAN. *Prom. Stroitel. Materialov*, **1941**, No. 1, pp. 30–34; *Khim. Referat. Zhur.*, **4** [7–8] 94 (1941).—When kaolin is heated at a constant rate, three thermal effects become manifest. On the basis of thermochemical and roentgenographic studies, the authors draw the following conclusions concerning these effects. The first reaction, at 400° to 700°, is an endothermal effect of the dehydration of kaolin. The product of this reaction is metakaolin. The second reaction, at 900° to 1050°, is an exothermal effect of the decomposition of metakaolin and the simultaneous crystallization of amorphous alumina into γ-Al_2O_3. The third reaction is an exothermal effect at 1200° to 1300° and corresponds to the formation of mullite as a result of interaction between Al_2O_3 and SiO_2. M.Ho.

Quartz-crystal applications. C. F. BOOTH. *Jour. Inst. Elec. Engrs.*, **90** (III) [9] 27 (1943).—The mode of action of a quartz-controlled oscillator and its uses are briefly outlined. L.R.B.

Roentgenographic determination of structure of ternary solid solutions of magnesium, silicon, and aluminum. V. G. KUZNETSOV AND E. S. MAKAROV. *Izvest. Sektora Fiz.-Khim. Anal., Inst. Obshcheĭ & Neorg. Khim.*, **13**, 177–90 (1940); *Khim. Referat. Zhur.*, **4** [9] 35–36 (1941).—Using the precision method of Preston, the authors determined the parameters of the lattice of the ternary solid solution Al-Mg-Si for 6 radial cuts starting at Al and going toward the side Mg-Si up to 2.2 wt. % (Mg+Si) as well as for Al-Si alloys up to 2.2 wt. % Si. Isotherms were constructed for the solubility of Mg and Si in Al at 550°, 500°, 400°, and 200°. The solubility of Mg and Si in Al at 200° is not more than 0.1% of the sum (Mg + Si) of the region delineated by the system Al–Si–Mg_2Si. The difference in the nature of experimental and calculated curves for the parameters of the lattice, assuming an atomic structure of a solid solution for alloys annealed from 550°, leads to the belief that the solid solution Al-Mg_2Si is molecular in its structure. On Debye diagrams of alloys annealed after heating at 550° and 200°, only lines corresponding to the lattice of Al were observed. Annealed and slowly cooled alloys containing 2.2% of Mg + Si and located on the pseudobinary and adjacent sections show, on Debye diagrams, weak additional lines corresponding to the lattice Mg_2Si. M.Ho.

Roentgenographic investigation (structure of Al-Mg-Si). V. G. KUZNETSOV AND E. S. MAKAROV. *Izvest. Sektora Fiz.-Khim. Anal., Inst. Obshcheĭ & Neorg. Khim.*, **13**, 191–200 (1940); *Khim. Referat. Zhur.*, **4** [9] 37–38 (1941).—Natural aging of alloys with a content of 1.2 and 2 wt. % of Mg + Si does not change the parameter of the lattice within the limits of experimental results. Artificial aging of alloys located on sections with 98.8 and 98.0 wt. % at 150° and 175° for 48 hr. results in a decomposition of the solid solution, causing a change of the parameter of the lattice approaching the values of pure Al. Alloys containing an excess of Mg compared with Mg_2Si did not change the parameters of their lattices after 48 hr. aging. This seems to point to the absence of a decomposition in this case. Along with the decomposition, there is also a distortion of the lattice of the solid solution. In the initial stages of aging the latter process predominates. With an increase of the Mg content in the solid solution, the distortion of the lattice increases. The decomposition of solid solutions upon aging does not proceed uniformly throughout the volume. This results in unequal concentrations of the components within various grains of the specimen and causes on the roentgenograms the appearance of a series of lines instead of the doublet (333) $K\alpha_1$ and $K\alpha_2$. The deformation after annealing greatly accelerates the decomposition of solid solutions upon aging. M.Ho.

Role of ions in the thixotropy of clay. A. I. AVGUSTINNIK. *Keram. Sbornik*, **1940**, No. 11, pp. 20–24; *Khim. Referat. Zhur.*, **4** [7–8] 25–26 (1941).—For the basis of his views, A. accepts the electrochemical theory of Endell and Vageler. The negative charge on particles of clay

is explained by the structure of its crystalline lattices. The basic units of this structure are $Si[O]_4$ tetrahedra arranged in lattices removed from each other by an appreciable distance. This permits intercrystalline swelling of these minerals which occurs because the "packets" move apart not unlike hinges, in consequence of which the aluminosilicate lattices are disturbed. This action occurs at the weakest links, i.e., at the points where the tetrahedra are joined by metallic atoms. It is at these points that alien ions from the dispersing medium penetrate into the lattice and replace cations from it. The difference in the diameters of these ions loosens the lattice considerably. The freed coordination bonds of Si tetrahedra bind the alien ions. The latter, however, do not arrange themselves in a monomolecular layer but rather diffuse and become surrounded by envelopes of the solvent (water) and by anions of the dissolved salts. The farther they are removed from the particle, the lesser is the density of the cations and the greater is that of the anions. A. shows how the nature of a typical colloid is affected by the nature of this diffused layer. By simple calculations for a fragment of a crystalline mica lattice, A. calculates the thickness of the solvated layer which is the average for most clay particles. He also calculates the average densities and pressure in the solvated envelopes of three different clays. Values given by other authors are quoted for comparison. The effect of the absorbed ions on the thixotropy of these clays was also investigated. The results confirm the disintegration of the aluminosilicate lattice by the cations which penetrate it. The effect of the cations is demonstrated by the displacement of the maxima of the thixotropy curves toward a higher moisture content and the curves themselves becoming more elongated. According to their effect on the extent of the thixotropy, the cations are arranged as follows: H> Na> K> Ca> Al. See "Thixotropic. . .," *Ceram. Abs.*, **22** [1] 20 (1943). M.Ho.

Sodium fluosilicate. L. C. OAKLEY. *Enamelist*, **20** [4] 20, 35 (1943).—Sodium fluosilicate is used in ceramic glazes, opal glass, etc., and in many other industrial applications. Most domestic sodium fluosilicate is produced as a by-product in the manufacture of superphosphate. The silicon tetrafluoride gas, evolved when sulfuric acid attacks phosphate rock, is absorbed in water. The water and silicon tetrafluoride react to produce fluosilicic acid (H_2SiF_6) and a highly hydrated form of orthosilicic acid ($H_2SiO_4xH_2O$). This latter material is precipitated in the form of a gel with the fluosilicic acid dissolved in the excess of water used in the process. Various problems encountered in the production of sodium fluosilicate are discussed. L.E.T.

Specific surface of powders. Modification of the air-permeability method for rapid routine testing. P. J. RIGDEN. *Jour. Soc. Chem. Ind.* [London], **62** [1] 1–4 (1943).—A simplified form has been developed of the air-permeability apparatus described by Lea and Nurse for measuring the specific surface of powders such as cements, using the Kozeny equation. In the modified apparatus, air is forced through the bed of powder by the pressure of oil displaced from equilibrium in a U tube connected to the permeability tube. The theory of the method is given in full in an appendix; where it is used for the routine examination of any particular material, the estimation of specific surface involves only the measurement of the time which elapses for the oil level in the U tube to pass two marks, from which the specific surface is calculated by the expression $S = K\sqrt{t}$, where K is the calibration constant for the apparatus and t is the time. Tests showed the method to give results almost identical with whose of Lea and Nurse. Compaction of the powder in 2-mm. steps is shown to give a reproducible bed of powder. L.R.B.

Spectrochemical procedure in clay analysis. A. E. AUSTIN AND L. B. BASSETT. *Jour. Amer. Ceram. Soc.*, **26** [6] 185–88 (1943).—Three figures, six references.

Stability of colloidal systems. A. I. RABINOVICH. *Uspekhi Khim.*, **10** [1] 16–31 (1941); *Khim. Referat. Zhur.*, **4** [9] 23–24 (1941).—R. reviews the present state of the problem of the stability and coagulation of colloidal solutions. He points out the particular importance for this problem of the balance between the attractional and repelling forces between the colloidal particles. Of the various theories proposed for this balance, the most plausible is that according to which the repelling forces are electrostatic and the attracting forces are those of Van der Waals. The calculations of Hamaker made on the basis of this theory are rough approximations and contain a number of arbitrary assumptions. R. also mentions the purely electrostatic theory of Levin and Derjaguin and the work of Langmuir according to which the repelling forces are generated by thermal movements of the particles. The theory of W. Ostwald, according to which coagulation is caused by the medium "pushing out" the colloidal particles, this behavior of the medium being induced by the electrolyte, cannot be regarded as well founded. R. further discusses the correlation between the ζ potential and the stability of colloids. Although for a number of actual colloidal systems the electric factor completely or to a large extent determines the stability, there is on hand the work of Kruyt and others which contradicts the direct relation between the ζ potential and stability. The determination of the ζ potential by cataphoretic methods is open to numerous errors such as may be caused by the necessity of using an additional liquid in macromethods, the presence of electroosmotic currents in micromethods, surface conductivity, relaxation phenomena, etc. A complete solution of the question of the interrelation between the ζ potential and stability will be possible only when unquestionable data are secured. Concerning the mechanism of the coagulating effect of electrolytes, the adsorption theory of Freundlich proved to be at variance with facts, but available data do not justify the rejection of the importance of adsorption in coagulation and explain coagulation merely electrostatically as is done by Kruyt and Verwey. For the coagulation of lyophobic colloids, R. considers most characteristic exchange adsorption with equivalent exchange of ion stabilizers for ion coagulators. He criticizes the theory of Kargin who attributes great importance to the molecular adsorption of electrolytes. The stability of lyophylic colloids is discussed. Although it is no doubt essentially conditioned by the presence of a solvate envelope, the mechanism of the latter is not yet fully understood. Whether the stability is due to the diffusion of the solvate envelope or also to other effects, as, e.g., those proposed by Deryaguin, is unknown. R. describes the work conducted in the laboratory of colloid chemistry at the Moscow State University dealing with the problems of the extent and kinetics of solvation, chemical structure of solvates, and the nature of solvation forces. A bibliography is appended. M.Ho.

Turbidity measurements by optical means. E. G. RICHARDSON. *Proc. Phys. Soc.* [London], **55** [307] 48–63 (1943).—When a beam of light passes through a fluid containing particles in suspension, some of the light gets through while the rest is scattered, i.e., diverted in random directions from the path of the original beam. The general law for the extinction of light is $I_x = I_0e^{-Kxc}$ (Lambert-Beer law), where I_0 is the incident intensity, I_x is the intensity after passing through a length of path, x, and c is the concentration. This law is found to hold for light of a single color provided the concentration of the suspension is not too great. When the color of the light is changed or if a mixed, i.e., white, source is used, then it is found that the extinction coefficient varies with the wave length of the light. Tests have been made with titanium oxide, sulfur, and zinc oxide, and particle size has been estimated by photoelectric means (sedimentation) and also by the centrifuge method. A specially designed apparatus for particle-size frequency determination is shown. 10 illustrations. See "Optical. . .," *Ceram. Abs.*, **20** [7] 175 (1941). L.E.T.

Van der Kolk method of determining refractive indices. R. C. EVANS AND N. F. M. HENRY. *Mineralog. Mag.*, **26** [179] 267–71 (1942).—The use of oblique lighting to determine whether the refractive index of a grain under

the microscope is higher or lower than that of the medium surrounding it (introduced by J. L. C. Schroeder van der Kolk in 1907) receives an optical explanation, particularly with regard to the effect of moving the substage condenser. Under a microscope without a condenser, the oblique illumination should be obtained by removing the polarizer and swinging the mirror some distance to one side If a condenser is fitted, it should be raised as high as possible and an extended source of light should be used. If a screen is then inserted into the path of the light at any convenient point below the condenser, but preferably as close to the condenser as possible, unambiguous results will be obtained. L.R.B.

Water glass from industrial waste. A. A. ROMENSKIĬ. *Zhur. Khim. Prom.*, **17** [10] 39–40 (1940); *Khim. Referat. Zhur.*, **4** [5] 88 (1941).—A detailed description of the production of water glass on the Bereznikov combine is given. The water glass is made from sand and a caustic solution in an autoclave at 190° to 200° and 15 to 16 atm. The product has a modulus of 2.7. M.Ho.

PATENTS

Titanium dioxide production. JELKS BARKSDALE AND W. W. PLECHNER (Canadian Titanium Pigments, Ltd.). Can. 412,401, May 11, 1943 (Nov. 1, 1939). G.M.H.

Titanium oxide production. C. M. OLSON (E. I. du Pont de Nemours & Co.). U. S. 2,319,824, May 25, 1943 (July 18, 1939).—A process for nucleating and hydrolyzing titanium salt solutions to obtain a hydrolysate which on calcination yields a TiO_2 pigment of uniformly small particle size and improved hiding power, tinting strength, and color.

General

Ceramic construction distinguishes new Chicago subway. ANON. *Ceram. Ind.*, **40** [5] 60–64 (1943).—Stations and station areas of the Chicago subway use a vast amount of ceramic materials; 25,000 cu. ft. of hollow tile, 15,000 glazed brick, and 3000 fluorescent lighting units are some of the items mentioned. 8 photos. H.T.

Ceramic ware as an adjunct to industrial technique. W. STEGER. *Keram. Rundschau*, **46** [37] 424–29 (1938).—Examples of articles of fine ceramic ware used for industrial purposes are discussed. Illustrated. See "Clay. . .," *Ceram. Abs.*, **19** [10] 235 (1940). M.V.C.

Chemically resistant silicates and their use in industry. G. A. BALALAEV. *Vsesoyuz. Sovet Nauch. Inzhenir.-Tekh. Obshchestv. Vsesoyuz. Tekh. Konferentsiya po Ekon. Tsvetnykh Metallov. Sektsiya po Ekon. Tsvetnykh Metallov v Khim. Proizvodstve, Leningrad, 1940*, 14 pp.; *Khim. Referat. Zhur.*, **4** [6] 94 (1941). M.Ho.

Fellowship Reports: Report of Dean. R. B. SOSMAN. *Bull. Amer. Ceram. Soc.*, **22** [6] 186 (1943). **Report of Special Committee on Rules.** D. E. SHARP, *Chairman. Ibid.*, pp. 186–87. **Report of Committee on Proposed History of Ceramic Education.** S. R. SCHOLES, *Chairman. Ibid.*, p. 187.

Flexibility is watchword when making complex and difficult products. ANON. *Ceram. Ind.*, **39** [3] 52–56 (1942).—The plant and products of the Selas Co., Philadelphia, are described. 6 photos. H.T.

Furnace efficiency. ANON. *Coke & Smokeless-Fuel Age*, **4** [43] 245–47 (1942).—The two ways of expressing efficiency, viz., (1) efficiency = useful heat/total heat input and (2) efficiency = quantity of work heat-treated /total heat input are contrasted. The first is appropriate to steam raising, and the second to such processes as carburizing and normalizing. Data given by H. Schwiedesen on the efficiencies of furnaces used in steel fabrication are quoted, and corresponding figures for coke ovens are calculated. L.R.B.

Industry Committee No. 59 appointed for stone, clay, glass, and allied industries. L. METCALFE WALLING. *Federal Register*, May 6, 1943. Reprinted in *Bull. Amer. Ceram. Soc.*, **22** [6] 209 (1943).

Los Angeles and Chicago gift shows reflect demand for utility ware. ANON. *Ceram. Ind.*, **40** [3] 42–46 (1943).—Illustrated. H.T.

National Roster and the engineer. KIRK MILES. *Bull. Amer. Ceram. Soc.*, **22** [6] 174–77 (1943).

Pittsburgh gift show reflects ingenuity of American ceramic manufacturers. R. G. GIBNEY. *Ceram. Ind.*, **40** [2] 54–59 (1943).—Illustrated. H.T.

President's address. LOUIS J. TROSTEL. *Bull. Amer. Ceram. Soc.*, **22** [6] 172–74 (1943).

Problems business should consider. JAMES H. GREENE. *Bull. Amer. Ceram. Soc.*, **22** [6] 177–80 (1943).

Properties of ceramics a new approach to wider markets. ANON. *Ceram. Ind.*, **40** [5] 41–43 (1943).—Many new market possibilities can be opened for the entire ceramic industry if we stop thinking in terms of products and start thinking in terms of properties. Illustrated. H.T.

Protests against mobilizing scientific and technical resources. ALLEN SIMMONS. *Bull. Amer. Ceram. Soc.*, **22** [6] 209–10 (1943).

Report of Committee on Content of Ceramic Courses. J. L. CARRUTHERS, *Chairman. Bull. Amer. Ceram. Soc.*, **22** [6] 190–91 (1943).

Report of Committee on Patents. FULTON B. FLICK, *Chairman. Bull. Amer. Ceram. Soc.*, **22** [6] 193–94 (1943).

Report of Committee on Standards. J. W. WHITTEMORE, *Chairman. Bull. Amer. Ceram. Soc.*, **22** [6] 187–90 (1943).

Report of Rules Committee. W. KEITH MCAFEE, *Chairman. Bull. Amer. Ceram. Soc.*, **22** [6] 194 (1943).

Report of Special Committee on the Status of Ceramic Engineers with the Selective Service Boards. A. I. ANDREWS, *Chairman. Bull. Amer. Ceram. Soc.*, **22** [6] 180–85 (1943).

Scientific solution of multiple-shift system. NATHANIEL KLEITMAN. *Mining Congr. Jour.*, **29** [1] 15–16 (1943).—As it takes several weeks to get adjusted to a new shift, shifts should not be changed except after an extended time. Three 8-hr. shifts that will least disturb the normal cycle of working daytimes and sleeping nights should start about noon, 8 P.M., and 4 A.M. Leisure time would follow the first and third and precede the second shift. If four 6-hr. shifts are to be used they should start at about 3 and 9, both A.M. and P.M. W.D.F.

Securing war work contracts is similar to obtaining peacetime orders. A. F. MACCONOCHIE. *Ceram. Ind.*, **39** [3] 40–44 (1942).—An enameling plant's equipment can be utilized efficiently for other work than enameling by securing subcontracts for war orders. Illustrated. See "Enameling. . .," *Ceram. Abs.*, **22** [5] 68 (1943). H.T.

Settlement of London due to underdrainage of the London clay. G. WILSON AND H. GRACE. *Jour. Inst. Civil Engrs.* [London], **19**, 100–27 (1942).—The type of settlement noticed in the Santa Clara Valley, Calif., in which portions have settled more than 5 ft. due to the removal of water from sand underlying soft clay, is occurring over the London area. Terzaghi's theory of consolidation of clay due to a surface load is applied to calculate the settlement, which is compared with observations by the Ordnance Survey of Great Britain. If allowance could be made for the pressure of buildings, good agreement would be shown. L.R.B.

Substitutes of ceramics. GORDON C. KEITH. *Clay Prod. News*, **16** [4] 1 (1943).—K. describes some ceramic substitutes such as clay practice bombs, bed "pigs," cooking ware, ceramic piping, etc. See "Ceramic. . .," *Ceram. Abs.*, **22** [5] 90 (1943). G.A.K.

BOOK

Methods of Investigation of Ceramic Materials. Edited by G. YU. ZHUKOVSKIĬ, K. I. KELLER, AND N. K. ANTONEVICH. Gonti, Moscow and Leningrad, 1939. 270 pp. Price 8.5 R. Reviewed in *Khim. Referat. Zhur.*, **4** [6] 94 (1941). M.Ho.

PATENTS

Ceramics. W. K. CARTER (National Aluminate Corp.). U. S. 2,318,753, May 11, 1943 (Dec. 1, 1939).—A process of producing ceramic articles which comprises the step of incorporating a hydrous zeolite gel with ceramic raw materials.

Clay activation. J. A. CROWLEY, JR. (Socony-Vacuum Oil Co., Inc.). U. S. 2,319,185, May 11, 1943 (Oct. 17, 1939).

Any Spare Time? We Need Abstracters

The following journals are at present unassigned. An abstracter for any of these journals should have the journal available and be prepared to submit abstracts regularly each month. Address all requests for assignments to the office of *Ceramic Abstracts*, 2525 N. High St., Columbus, Ohio.

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American Journal of Surgery
American Standards
Anales de la Asociación Química Argentina
Anales de Fisica y Química [Spain]
Anales de la Sociedad Cientifica Argentina
Antiques
Archives of Dermatology and Syphilology
Arkansas Geological Survey Bulletin
Arts and Decoration
Building Standards
Brick Builder
British Clayworker
British Dental Journal
Brit. Elec. & Allied Inds. Research Assn. Rept.
British Steelmaker
Bulletin of the Air Hygiene Foundation
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(*Continued on page 130*)

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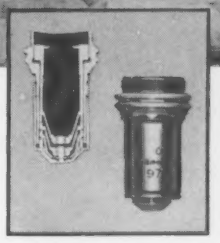

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(*Continued from page 129*)

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Concrete and Constructional Engineering
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Industrial Finishing
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Journal of the American Dental Assn.
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Mining and Metallurgical Society of America Bulletin
Modern Machine Shop
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Monthly Review of the American Electroplaters' Society
National Engineer
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Proceedings of the Cleveland Institution of Engineers [England]
Proceedings of the Institute of British Foundrymen
Proceedings of the Institute of Vitreous Enamellers
Proceedings of the Iowa Academy of Science
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Proceedings of the National Smoke Abatement Society, Annual Conference
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School of Mines and Metallurgy, University of Missouri, Bulletin
Science and Art of Mining
Sheet Metal Industries
Soil Science Society of America, Proceedings
Stained Glass
Times Literary Supplement
Tin Research Institute Publications; Tin and Its Uses
Trans. Inst. Mining & Metallurgy
U. S. Dept. Labor, Div. Labor Standards, Bulletin
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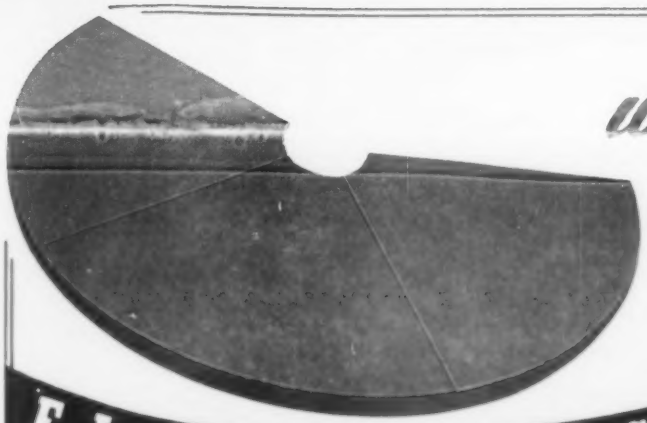

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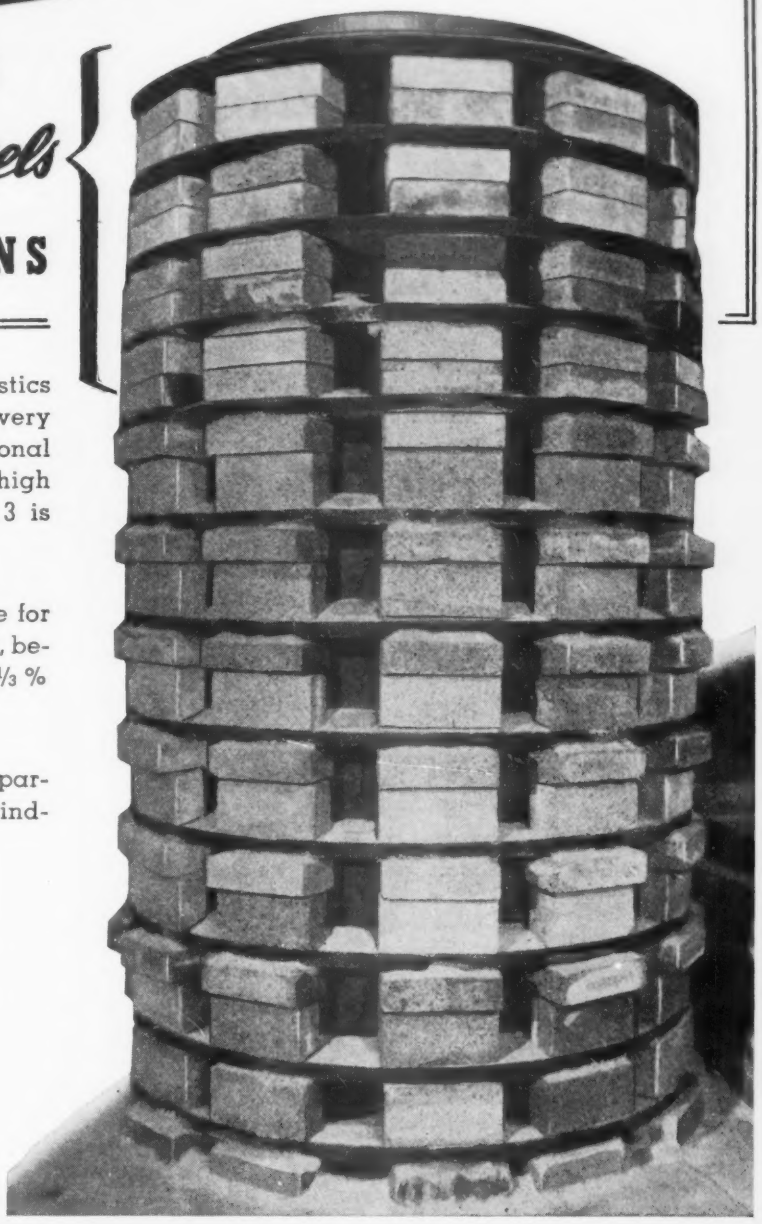

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THE BULLETIN SECTION

Volume 22 July 15, 1943 **Number 7**

GEORGE HERBERT BROWN

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Biographical Sketch by Emma L. Nawrot

Professor George Herbert Brown, outstanding in the field of ceramic education and research, was born in Miamisburg, Ohio, on May 18, 1884, the son of William H. and Amanda Drayer Brown. His father was a Lutheran minister and George was one of eight children born to the family.

Professor Brown attended grammar school in Miamisburg and was graduated from the high school in Doylestown, Ohio, where the family had moved in the meantime. Although his parents could not afford a college education for him, he was determined to continue his studies. Faced with the problem of finances, he enrolled at Ohio State University primarily because he had a married sister living in Columbus with whom he could reside while attending college and curtail expenses to a large extent. He decided to take the course in ceramic engineering. It appealed to him strongly because, being a new field of endeavor at that time, he thought the possibilities of securing employment in ceramics would be greater and, furthermore, he liked scientific subjects.

Going through college, however, presented a greater financial struggle to Professor Brown than he anticipated. Twice he was compelled to drop out of school for a year to go to work and earn money to carry him through. Thus, he earned his college education the hard way, finally receiving his Bachelor of Science degree in Ceramic Engineering from Ohio State in 1908. In 1933, he was awarded the professional degree of Ceramic Engineer from the same institution.

Upon graduation from college, Professor Brown went to work for a brick company in Alexandria, Virginia. The following year, in 1909, an opportunity was offered him to take a position at the newly established Pittsburgh Station of the National Bureau of Standards, where he worked under A. V. Bleininger, first as a Junior Ceramic Chemist and later as Assistant Ceramic Chemist. While here, he undertook many studies and researches including the properties of paving brick in relation to their life in the street, tests of the toughness of clays, the function of time in the vitrification of clays, the effect of mixtures of clay on vitrification, the resistance of refractories to pressure, their resistance to slagging action, the production of synthetic slag brick, the properties of porcelain bodies, and the reproduction of the Marquardt porcelain bodies for pyrometer tubes. Professor Brown was the first to make tubes of this kind from American materials. He was also instrumental in preparing the pottery exhibit of the Bureau for the San Francisco Exposition, which was awarded the gold medal, and in 1914 installed the use of the Keppeler caustic soda process for the purification of kaolin in a plant near Saylorsburg, Pennsylvania. His extensive work at the National Bureau of Standards was a steppingstone to his future success.

In 1916, Professor Brown resigned from the National Bureau of Standards to accept an appointment as Director of the Department of Ceramics and Professor of Ceramics at Rutgers University, a position he most ably filled until his death. He succeeded C. W. Parmelee, who organized the Department and served as its Director from 1902.

When Professor Brown came to Rutgers, he found the Ceramics Department an insignificant branch of the University, housed in a two-story brick barn consisting of six small rooms with a total floor space of approximately 1600 square feet to which a one-story brick addition was built on. The equipment in the Department consisted of the usual clayworking machinery and one coal-fired kiln.

After eighteen years of service to the industry and with an increasing interest in ceramic education, the Department outgrew its quarters. A campaign was launched to secure a new building, strongly supported by the New Jersey Clay Workers' Association (now the Ceramic Association of New Jersey) under the leadership of Charles A. Bloomfield, Charles H. Cook, Abel Hansen, August Staudt, Roy W. Minton, and Professor George H. Brown. Finally, after many hearings and through the efforts of Senator Thomas Brown, a bill was passed in the New Jersey Legislature granting an appropriation of $100,000 for the erection and equipment of a new Ceramics Building at Rutgers University. To this amount, an additional fund of more than $25,000 in materials, equipment, and financial aid was contributed by various ceramic companies in the State and vicinity. Ground for the building was broken during the summer of 1921, and the completed building was dedicated on Commencement Day, June 13, 1922, which also marked the twentieth anniversary of the founding of the Department at Rutgers.

This event had a double significance in the history of the Department as earlier on that day Rutgers University conferred the honorary degree of Doctor of Science upon Edward Orton, Jr., the pioneer in ceramic education. In honor of this memorable occasion, Ross C. Purdy suggested that a full-size portrait photograph of Professor Orton be presented to the Department by his former students, and this handsome picture now hangs in the Ceramics Building.

The dedication of the new building at Rutgers was an impressive occasion with many dignitaries and leaders in ceramics attending. A lion's share of credit was given to Professor Brown for obtaining the handsome building. In speaking at the dedication, W. H. S. Demarest, then President of Rutgers, remarked: "We owe the erection of this building not only to the State of New Jersey, but to those men who have shown a great personal interest in this work; to Senator Brown, for his untiring efforts in securing the appropriation; to Professor Brown, whose consistent work and constant application to the undertaking has brought about this successful conclusion; and to others closely affiliated with the New Jersey Clay Workers' Association." It is no doubt that the brunt of the work in this endeavor fell upon Professor Brown, and the building will always stand as a monument of his work and a tribute to him.

Throughout the twenty-seven years as Director of the Department, Professor Brown worked untiringly in promoting its interests, and those who have worked with him can well appreciate the time and effort he devoted to this purpose. Under his able direction and guidance, the Department had made great strides and has taken one of the leading places among ceramic institutions in this country.

Along with ceramic education, Professor Brown contributed extensively to ceramic research. He directed researches for the Tile Manufacturers' Association, American Gas Association, China Clay Importers, American Optical Company, and numerous other companies. In addition, he headed a survey of New Jersey fire clay and shale sponsored by the Works Progress Administration and carried on with a view to the utilization of New Jersey deposits in the manufacture of ceramic ware. He also conducted numerous special researches on whiteware bodies and glazes, roofing granules, spark plugs, refractories, clays, ceramic colors, and crucibles and directed the work of the Edward Orton, Jr., Ceramic Foundation Fellowship maintained at the Department of Ceramics at Rutgers University since 1936.

Recognized by many as an authority on ceramics, he was frequently consulted on ceramic problems, and the information and assistance he gave have proved invaluable. From 1924 to 1929, he served as a ceramic consultant for the Port of New York Authority in the construction of the Holland Tunnel, and all ceramic tile used in that structure was tested under his direction. He also served in this capacity more recently in connection with the building of the Lincoln and Queens Midtown Tunnels.

Upon learning of Professor Brown's death, Ole Singstad, Chief Engineer of the New York City Tunnel Authority, writes: "I have been associated with Professor Brown intermittently for over twenty years, and I have learned to prize him highly both as a man and as an engineer. He has been a most valuable consultant in developing the tile for vehicular tunnels which now has reached a stage, as represented by the Queens Midtown Tunnel, of what I consider a perfect tile for the purpose, starting practically from scratch in 1922 in connection with the Holland Tunnel investigations.

"Only about a week ago, I completed the final guarantee inspection of the tile in the Queens Midtown Tunnel at the expiration of the guarantee period, and on the entire project not a single tile was found which could be classed as defective due to an inherent defect in the tile or in its bonding to the wall. This is a most gratifying experience. . . ."

In February, 1942, Professor Brown was appointed in a consulting capacity to the War Production Board as a Principal Industrial Specialist on talcs and steatite. He carried on this work in addition to his duties in the Department, making frequent trips to Washington and just before his illness undertaking a trip to the West Coast for the Government.

Professor Brown was very active in many societies and technical organizations. He was a prominent figure in The American Ceramic Society, serving as its President in 1917–1918 and as first editor of *The Journal* of The Society in 1918–1920. He was a Fellow of The Society and a member of the Board of Trustees on two occasions, as well as having served on many committees. He had also been President of the Rutgers Chapter of Phi Beta Kappa, Sigma Xi, and the New Brunswick Scientific Society, and held membership in Keramos, Phi Lambda Upsilon, American Society for Testing Materials, American Association of University Professors, and the Rutgers Ceramic Club and Student Branch of The American Ceramic Society, of which he was councillor.

Closely associated with his work in the Department were the activities of the Ceramic Association of New Jersey (formerly the New Jersey Clay Workers' Association, the organization having changed its name in 1932). Professor Brown served as its Secretary-Treasurer from 1916 until his death and was responsible for most of the pioneering and organization work in the group. The Association now has a membership of 240 persons representing practically every branch of the ceramic industry in New Jersey and vicinity. Credit for the great success of the organization can be attributed to the "guiding hand" of Professor Brown who always took such pride in the meetings and other activities of the Association. He enjoyed greatly working with this group and won the admiration of all for his keen interest, loyal cooperation, and enthusiasm. He also took an active part in the founding of *The Ceramist* and was a consulting editor of *Ceramic Age*.

Professor Brown married Mary L. White, of Fremont, Michigan, in September, 1911. They had four children: Herbert D. (now captain in the U. S. Army), John N. (also serving in the armed forces), Mary Ida (Mrs. Daniel H. Lipman), and Betty Anne. He died in St. Petersburg, Florida, on February 8, 1943, after an illness of several months.

Professor Brown's untimely death leaves an irreparable gap. He was always so deeply interested in every phase of ceramics and gave so liberally of his time, effort, and energy in its behalf. His entire life and career seemed to attain to that end, and with his passing the ceramic world suffers the loss of a great mind.

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(2) (With A. V. Bleininger) "Viscosity of Clay Slips," *ibid.*, pp. 596–604.

(3) "Method of Testing Clays for Paving Brick Purposes," *ibid.*, **12,** 265–76 (1910).

(4) (With A. V. Bleininger) "Behavior of Fire Brick under Load Conditions," *ibid.*, pp. 337–69, and **13,** 210–25 (1911).

(5) "Relation between Crushing Strength and Porosities of Clay Products," *ibid.*, **14,** 292–300 (1912).

(6) "Load Tests made on Magnesite, Chrome, and Silica Brick," *ibid.*, pp. 391–93.

(7) (With E. T. Montgomery) "Dehydration of Clays," *ibid.*, pp. 709–22.

(8) (With G. A. Murray) "Function of Time in Vitrification of Clays," *ibid.*, **15,** 193–216 (1913).

(9) (With A. V. Bleininger and C. S. Kinnison) "Study of Some Calcareous and Magnesian Slags," *ibid.*, pp. 547–69.

(10) (With A. V. Bleininger) "Veritas Firing Rings," *ibid.*, **16,** 222–34 (1914).

(11) "Report on Rattler Tests Made on Brick Obtained from Paved Streets," *Trans. Amer. Ceram. Soc.*., pp. 364–70.

(12) "Relative Thermal Conductivities of Silica and Clay Refractories," *ibid.*, pp. 382–85.

(13) "Viscosity of Some Shales at Furnace Temperatures," *ibid.*, pp. 571–76.

(14) (With W. L. Howat) "Use of Deflocculating Agents in Washing of Clays and Effect of Process on the Color," *ibid.*, **17**, 81–90 (1915).

(15) "Study of Fire-Clay, Shale, and Surface Clay Mixtures with Reference to Their Porosity-Temperature Relations," *ibid.*, pp. 450–57.

(16) (With A. V. Bleininger) "Relation between Modulus of Elasticity and Porosity of Fire Clay," *ibid.*, pp. 464–70.

(17) (With A. A. Klein) "Microscopic Investigation of Some Compounds Noted in Systems Soda–Zinc Oxide–Silica and Soda–Zinc Oxide–Titanic Oxide–Silica," *ibid.*, pp. 745–59.

(18) "Method of Testing Corrosive Action of Slags on Firebrick," *ibid.*, **18**, 277–81 (1916).

(19) "Sagger Clays and Mixtures," *Jour. Amer. Ceram. Soc.*, **1** [10] 716–29 (1918).

(20) "Burning of Porcelain," *Ceramist*, **1** [3] 204 (1921).

(21) "Ceramic Department at Rutgers College and the State University of New Jersey," *Jour. Amer. Ceram. Soc.*, **6** [1] 93–97 (1923).

(22) "Effect of Fineness of Grain of Flint and Feldspar," *Ceramist*, **4** [1] 29 (1924).

(23) "Notes on Production of Cream-Colored Bodies," *Ceram. Age*, **11** [3] 77–79 (1928).

(24) (With R. L. Clare and F. B. Allen) "Terra-Cotta Kiln Slab Investigation," *Jour. Amer. Ceram. Soc.*, **12** [1] 62–68 (1929).

Patents

(1) "Glazed-Rock Granule Surfacing and Roofing Surfaced Therewith," U. S. 1,831,784, Nov. 10, 1931.

(2) "Coloring Ceramic Materials," U. S. 1,960,329, May 29, 1934.

PLANS FOR POST-V DAY

WAR COUNCIL OF THE STRUCTURAL CLAY PRODUCTS INSTITUTE*

By Douglas Whitlock†

I. Introduction

I welcome the opportunity to be here and discuss with you the many problems of the clay products industry, its current status in the economic picture of today, and its future possibilities. I welcome this opportunity because only at a meeting of The American Ceramic Society is the entire industry together, an industry dependent on mother earth and her vast deposits of clay for its lifeblood, but ranging in its versatile production from the sturdy structural units to the fine delicate porcelains and china.

I come before you as a representative of the structural units, including building and paving brick, structural clay tile, and unglazed and glazed facing tile. I make this statement so that you may better know of what products I speak when I mention production figures or shipments and analyze some of the problems that confront this portion of the clay products industry.

The War Council of the clay products industry is something new, something not entirely clear in concept or relationship to the industry. I have found from experience that new things are not entirely axiomatic in this industry, which is steeped in tradition and prone to follow the methods that have been satisfactory in the past. The War Council is new; it is a baby of rapid growth, having been born at the meeting of the Structural Clay Products Institute directors in November, taught to crawl in December, and raised to a mature and robust youngster standing on its own two fighting feet early in March. Often it has been said that necessity is the mother of invention, and well might this term be used with respect to the War Council, as necessity and industry problems can truly be called its immediate ancestors. A discussion of any program must naturally include a bit of its paternal and maternal history, so I shall discuss some of the industry problems that have laid the foundation and created the necessity of forming a War Council at this time.

I have been with the industry for the past ten years, during which time I have had every opportunity to study the industry intimately and from all angles, and it is my belief now, as it was at the outset, that the industry has a solid future, but that its problems are many and complex.

Many of its problems will remain unsolved for various reasons, such as lack of finances, disinterest in organized support, lack of personnel, or lack of proper timing. Having studied the industry closely and having tried hard to analyze its shortcomings, I believe that for the next twenty-five years, regardless of economic conditions, the main problems of the industry will be production, marketing, and use.

II. Production

(1) Overproduction

Let me stress point number one by saying that the basic fault of our whole industrial problem lies in overproduction by our plants. The heavy clay products division maintains approximately 800 plants, which operate in the greatest construction market the world has ever known and at but 35% of their capacity. You cannot have a 35% production capacity in history's largest construction program without developing a series of most serious and severe problems for the producers. If, by some quick stroke of magic, we

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† General counsel for the Structural Clay Products Institute. Washington, D. C.

could wipe out enough production to allow 60 to 80 manufacturers to operate at, for example, 65% of capacity, then our problems would decrease materially in their severity. As long as this overproduction exists, our industry will continue to be confronted with problems more complex and more serious than any which plague all other industries in existence, and the situation calls for cool, hard thinking on the part of those who are prone to guide its destinies. But as dark as this may sound, the problem is not unsolvable.

The producers of glazed and unglazed facing tile have conducted an intensive and detailed survey of conditions affecting their welfare and have found that productive capacity was away over and above requirements. They immediately began to work on a definite program of retrenchment, but, unfortunately, we have antitrust laws that make such a course hazardous and sharply defined. Probably some day it will be necessary and profitable to teach our governing forces that the clay products industry has specialized problems to the extent that it may finally be given a little Guffey Act.

III. Marketing

Point number one goes hand in hand with point number two, which is marketing, because overproduction results in selling at a low price when compared with the cost of production. Prices in the clay industry today are at the 1935 level, whereas production costs are considerably higher. Every analysis made of the industry, either by investigating committees of the industry or by Government agencies, during the past ten years has shown that the monetary return to plants is not over 3% and in most cases is but 0.003 on invested capital. Such small returns make it impossible to secure sufficient finances to carry on the promotion so necessary to the industry's progress. Because of such existing conditions, both the program of the Structural Clay Products Institute and the War Council must necessarily be limited. In our War Council effort, the plea for support went to approximately 800 manufacturers and brought in only $60,000. For the same reason, many are not in a financial position to give the $^5/_{10}$ of 1% for Institute dues, as in a good many cases this amount means the difference between profit and loss.

(1) Standardization

Standardization could be helpful in this respect, but standardization has resulted in productive competition. The industry now has a production competition which is becoming serious in some sections of the country. To reduce the cost of manufacturing, some producers are making large-size units, but others are resisting this movement because of their inability to change manufacturing processes or their refusal to accept a change.

An analysis of the facing-tile branch of the industry indicated that $100,000 could be saved through standardization, which, if adopted, would, of course, bring better returns to the industry.

Standardization would also assist in developing a common viewpoint, which today does not exist in the industry. In fact, viewpoints are so localized that they differ in adjoining regions only a few states apart. I have gone many times into one regional area to discuss the matters of an adjoining region only to be told that their traditions preclude doing likewise or, for this reason or that, such a matter is good for over there but will not work here.

(2) Transportation

Transportation is another factor in the localization of our industry. It has localized the products, and hence local problems become intensified further. The resistance to a free flow of products throughout the country is also another phase in the absence of a common national viewpoint. Little headway has been made in localization. Only the facing-tile producers have approached their problems on anything amounting to a national basis; the other producers confine their thoughts to their immediate territory, and it takes great effort to induce an Iowa meeting, for instance, to discuss the doings of Pennsylvania producers because they do not do it their way and they are not at all interested.

(3) Sales Agencies

Another handicap in the marketing of our products is the lack of a uniform distribution system. We are at variance on all points because of our lack of uniformity, and tradition here again dictates policies regardless of efficiency or results. There are those who sell through the dealer, whereas others refuse this outlet and sell direct. Some have distributors and others follow all methods, but so long as the industry's so-called system of distribution remains as it is, the cost of selling will remain at a high level and returns will remain low. The industry adopted a dealer-relations policy at one of its annual conventions, but little support has been given the dealer conventions. The Institute could not follow the dictates of the plan because it feared criticism from those who circumvented the dealer in their selling methods. For the same reason, the Institute cannot follow a definite plan in working with the building contractors because many of its producer members are not sure that they want to distribute their ware through these channels.

The architectural profession offers an outlet which has been to a large extent cultivated by the old associations in the industry, but the picture has changed materially. This profession as a whole has permitted the entire building program to slip through its fingers, and today the architectural profession is practically a branch of Government service.

Marketing is such a vital cog in the machinery of the industry's economic welfare that I could dwell on the subject for a long time. I hope, however, that my few remarks will have convinced you that in spite of its importance, marketing remains today in a very chaotic stage.

IV. Use of Materials

(1) Labor Unions

This subject immediately brings to the front the trade on which we are so dependent, the brickmason. He stands between our plants and the finished project, be it a home or a factory. We have found that his reputation is the direct cause of the resistance our materials receive by the building agencies of the Government. They are not especially worried about cost, but they do fear his performance.

The Institute itself is operating on a pleasant relationship with the B.M. & P.I.U., but the local unions are extremely difficult to work with and present a serious problem to our

welfare and progress. The solution of the manufacturer-laborer relationship in this country is still at the crossroads. It is being nurtured by Government policies, and our industry, as others, must move along with it.

(2) Building Designs and Units

Design is another point that involves the use of our materials. The Institute is constantly at work on this problem in cooperation with other building materials working through the Producers' Council, but even here hardships are encountered. A discussion of age-old brick brings polite attention, but let someone come into the meeting and discuss prefabrication, and ears will prick up and eyes will brighten with interest. Such a person can take away the spotlight because he has something new to talk about. Designers know little about brick and tile because they are not taught their qualities and uses in school, and it becomes a problem to determine whether or not they can be made to show an increased interest in new or different products. This is strictly a promotional job and a costly one.

Large units present another use problem. If they are made too large, the laying cost is increased out of proportion, and a definite analysis has never been made to determine what size of unit is the most economical to make and lay. Because of the varied units made in the industry, it is difficult to sell either a private or a Government job.

(3) Promotion

Promotion to increase the use of brick and tile is a dual job involving the Institute and the individual producer. The organization can supply money, make contacts, and handle other matters, but it is the responsibility of the manufacturer to assist. It takes organization to do a thorough job, but a great many of our manufacturers do not understand organization and do not have it in their own companies. In many cases, the so-called manager keeps the books, runs the sales department, and supervises production. But in spite of the complexities I have mentioned, our problems are not insurmountable. Their solution requires planning and ingenuity, but thinking is going on, and that is a good sign. Even the Government is thinking of our problems. Only recently Thurman Arnold said to me, "You are an industry that has terrible problems, and you are too small to get action by Congress. Use the war agencies for all the help you can get."

That, then, is the picture of our industry as we entered wartime conditions. Because of the low returns previously mentioned, we found ourselves confronted with the trick of doing a tremendous promotional job with our possible income rapidly diminishing. We were faced with the promotional efforts of competitive materials such as lumber, cement, aluminum, and others to come. A closer cooperation within the industry to combat the inroads of competition was needed, and, accordingly, we stepped beyond the confines of the Institute membership and out into the industry itself to form what we term the War Council.

V. The War Council

The War Council presents an opportunity to the manufacturers to contribute on a plant-capacity basis to a general program designed to pull the industry through the present economic era and launch it with full strength into the building program of the postwar period. The Institute is supported by dues based on the dollar value of sales. The War Council support is based on a contribution scaled in proportion to plant size and payable either in one lump sum to cover a year's contribution or in monthly installments.

To properly acquaint the industry with the idea, a series of regional meetings was called in all sections of the country, and representatives of SCPI attended each meeting to explain the plan and solicit contributions. The initial swing of the circuit was started in December and was completed before Christmas. Although the results did not come up to expectations, approximately $60,000 were subscribed which, when added to the expected dues for the coming year, put us in a position to plan a $100,000 program for 1943.

As someone once said, "The solution of one problem usually creates a new one to solve," and we found ourselves not immune to the influence of this axiom. Having solved our financial difficulties to a certain extent, at least temporarily, we were immediately confronted with two schools of advice; one advocated the immediate spending of the entire War Council Fund for an all-out promotional program, and the other whispered caution and advised a long-pull program to maintain the industry at an even keel and lead it into better times.

This question was presented to our Executive Committee at its recent meeting with the result that we were authorized to proceed along two definite channels of promotion, namely, (1) a publicity program, now being formed for its execution, and (2) an all-out effort to get the most out of the current construction program.

That meant working with Uncle Sam, the number one purchaser of building materials. Working with Uncle Sam no longer means Washington contacts, but, because of decentralization, it means going out into the field and contacting the construction agencies at their regional headquarters. With this in view, another circuit of meetings was planned and called. At each meeting, the plan of personal contact with such agencies as FHA, NPHA, and the Army and Navy was explained. It was pointed out that although every effort would be made by the SCPI representatives to contact personally the several agencies in each regional area, the real value of the program could best be brought out through consistent calls and accordingly dollar-a-year men were appointed to carry on these calls as directed from the Washington office. In each area, many calls were made by the SCPI representatives in company with the appointed dollar-a-year men.

Two special publications were prepared to leave with the persons contacted. The one publication, called "Technical Notes," represents a collection of papers prepared by our Department of Engineering. It is entirely technical in scope and is designed to acquaint the recipient with the qualities and workability of brick and tile. The other publication, termed "Production and Performance," gives a detailed analysis of the availability of our materials within the region, including the plant, the size, and products manufactured.

As each contact is made and information is obtained regarding probable future jobs or work being planned, reports are sent to the SCPI office where they are repro-

duced and sent to all members of SCPI and War Council subscribers within the region. Where follow-up calls are necessary, the dollar-a-year men in the area are instructed on whom to call, and the proper literature is sent to them for presentation at the time the future call is made. Reports on such calls are then sent in and again reproduced and distributed.

To guide the dollar-a-year men, a special Directory has been prepared which shows the breakdown of the Government building agencies and lists the proper persons to be contacted. Through this system, the men in control of building operations in every area are being consistently visited and advised regarding the qualities and availability of brick and tile. In turn, any data secured through these visits are sent out so that all members and War Council subscribers are at all times kept informed of building conditions in their areas.

Although this War Council program has been in operation for little more than six weeks, it is showing remarkable results. I have just received a report from one engineer in charge of War Council operations in which he mentions that, to date, ninety-six calls have been made on the field offices of Government construction agencies. This includes seventy-six initial calls made by SCPI engineers accompanied by War Council representatives or dollar-a-year men, plus twenty follow-up calls made by these gentlemen. These personal contacts were made with such influential persons as the division engineers, district engineers, and area engineers of the U. S. Engineers Corps which covers the Army; the superintending civil engineers, public works officers of Navy yards, operating bases, and training stations of the Navy; and the NHA regional offices, FPHA regional offices, and FHA state offices, which cover all housing projects. From these conferences we have received invaluable information regarding the immediate and future programs of all of the important construction agencies of the Government, which, as mentioned before, is passed on to the subscribing members for their guidance and benefit.

VI. Present Status

The following summary of the report on these activities is interesting:

"There still remains a substantial volume of construction, although sharply reduced from the peak reached last fall. There will be additional curtailments which will be noticeable around June 15. There are indications that the ratio of clay products used to dollars spent for construction will be substantially higher than in 1942.

"The majority of Government agencies are aware that lumber is hard to obtain, slow in delivery, and, in most cases, poor in quality. All regional offices are interested in our presentations of what has been done with clay products in other regions and are anxious for information about successful projects.

"The presentations made by SCPI engineers and dollar-a-year representatives are being well received. Many engineers agreed to include clay products as options, or as alternates, on work which had been constructed largely of other materials and to use clay products if costs were reasonable. Many were interested in the data because of its application to a postwar program.

"SCPI engineers making calls on regional offices of Government construction agencies can be considered a successful and effective method of promoting the use of clay products."

This completes my story of our division of the industry. We have and always will have problems, but they can be and are being solved. What we are doing now, although currently productive, is also spadework for the program of the postwar period, which indications tell us will be enormous. All of this makes us hopeful, and accordingly we are working hard, in unison and harmony, to get the most out of today and pave a road into a brighter tomorrow.

GLASS AFTER THE WAR*

By Alexander Silverman†

I. Introduction

The last half century has resulted in greater progress in glass technology and manufacture than the thousands of years which have preceded it in the history of civilization. Almost two hundred manufacturers are engaged in a five hundred million dollar industry in America alone. A goodly portion of their accomplishment is still withheld from the public because of the necessities of war. In time this progress will be known, and mankind will derive the benefits in the postwar period. What are some of the possibilities that we may hope for?

II. Plate and Window Glass

We have thought of plate glass in terms of the shop window and the laminated panes in vehicles. More extended possibilities loom on the horizon. In the House of Tomorrow at the New York World's Fair, sliding plate-glass partitions converted one room into two, or two into one, at the occupant's will. These partitions in the new house of tomorrow may not only serve the purpose for which they were intended in 1938, but they may consist of laminated polarizing plates, one of which will cross the other in a double wall construction and produce an opaque partition between the rooms. By sliding one of the two partitions of the double wall back or forth, light or darkness will result. There is the further possibility of having attractive metallized continuous decorations on the plate-glass walls, which may be heated moderately by electricity and serve as radiating surfaces to produce warmth. Although the combination of polarizing plates with heating elements is not feasible, partitions of clear, colored, or even black glass could serve as heating elements. The selection of suitable sizes of plates would still permit an appreciable passage of light when opaque panels are open.

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The occupant of today's home depends on the porosity of the plaster walls for partial admission of air to the dwelling. You may wonder about the all-glass house of tomorrow. Glass with small conical perforations could be installed. Air could enter through the small openings from one side and be drawn in that direction by the injector effect of the larger opening on the other side. The air might be dust-free after passing through a glass-wool filter with a sticky adhesive before entering the partition.

Supplementing the warmth-radiating walls, we might have individual stoves of metallized plate or sheet glass, artistically designed and capable of emitting heat in any part of the room. The floors could be metallized like the walls; or, if one preferred, there might be glass foot warmers or hassocks, which could be distributed at will. A room at 60° insuring warm feet and uniform radiation toward the body from all sides would be more comfortable than today's home at 70° or higher. The decorative possibilities of the heating units or areas are unlimited. Plates or sheets could be of almost any color, and, as the decoration is on the underside, it would appear as a second tone in the color scheme of the glass host. Decorative enamels or glass silhouettes could be applied. Surfaces molded to any desired contour are now possible. Everything does not have to be flat. As the heating elements do not preclude illumination, the combined heating and lighting effects should be entrancing.

Tempered glass doors may lead from one room to another and cover cabinets and closets, bookcases, and various other recessed compartments in the walls. They may be transparent to reveal objects of beauty or they may be opaque. Mirrors may be a part of the wall here and there or they might be used as doors for some of the compartments. Some day, when the aluminized mirror becomes available, we may have it in our bathrooms with frames of tubular mercury-vapor lamps encased in a glass which will transmit desirable therapeutic waves to the aluminum mirror. The partial aluminum backing of the tubes and the metal on the mirror will provide health-giving rays for the sun bather.

Now, what about glare? You would say that all of these bright glass walls with their reflections would be annoying—would cause eyestrain. The modern treatment of sheet glass by producing thin etched films of molecular dimensions eliminates glare. Instead of having 10% of the light reflected to annoy you, practically 100% would pass through the glass, unless it were opaque, and then the surface could be etched more deeply to prevent reflection.

To help warm the house in winter, glass skylights and other structural parts of special composition may permit infrared rays to pass in. Properly mechanized construction should enable us to replace these in summer by iron-containing units which will absorb the heat rays and keep us cool.

Will the house of tomorrow possess an attractive external appearance? Although plates and sheets have been used internally and have produced attractive exteriors in black, white, and colors, other structural forms may be used for both external and internal construction.

III. Hollow Tile and Blocks

The manufacture of glass brick and hollow tile had its practical beginning in the present century. Several dozen hollow tile designs are now available. Although they have been employed primarily in factory construction, they are capable of most artistic treatment, as was evident in the beautiful Saint Gobain building at the last Paris Exposition. Design will evolve from the utilitarian to the artistic, and the glass house of tomorrow will not be limited or severe. The blocks will be produced in various colors—opaque, translucent, and transparent. With bent or specially shaped plate glass and with various hollow tile, streamlines will enter the architect's drawings. There will be graceful curves and decorative motifs. What we may expect is already evident in the Casas Pernambucanas in São Paulo, Brazil (see Fig. 1). Its exterior represents the waving flag of the state of São Paulo.

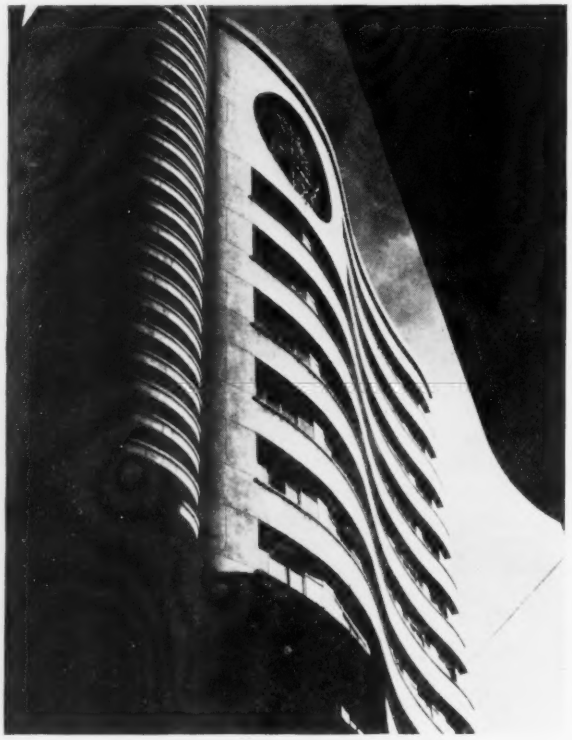

FIG. 1.—One of Brazil's most unusual bits of architecture is the Casas Pernambucanas in São Paulo, which is built in the form of the flag of the state of São Paulo. The strip windows are the stripes of the flag; the circle at the top is the seal; and the narrow horizontal windows at the left which give light to the stair and elevator hall represent the flagpole.

When the windows of our day are excluded, they may be replaced by (1) transparent tile sections, which will be practically free from defects and will transmit undistorted images to the eye and (2) by double-plate or window-glass units. For sections which are not transparent, directed lighting made possible through various prism designs in the glass tile may be desirable. Visibility in blocks can be destroyed by the irregularity of design or by the insertion of thin glass cloth.

Although it is assumed that the furnishings of the home of tomorrow will be nonflammable, our glass refrigerators

might be operated by toxic refrigerants, and we might have flammable and harmful volatile chemicals in the home for various purposes. If, for example, the passageway between an inbuilt garage and a residence were left open, combustibles and fumes might endanger the occupants. Nonflammable, nontoxic, and odorless refrigerants are available, but not all refrigerators are thus equipped. Safety exits should be provided. Perhaps we shall so build that the secret panels of the old castle will again come into being, and it will only be necessary to push a button to release them and let us descend in our glass cloth parachutes.

Foam glass, full of air bubbles, is a new heat insulating material which we shall use extensively. It will be made with fused surfaces, perhaps sufficiently heavy fully to protect the fragile interior. If and when it becomes available, we may have fairly large sections which can be used for panel construction in prefabricated houses. Within the home we shall probably be using foam glass floats in cast-glass toilet tanks.

But there is a new vista of which few persons have dreamed. In 1914, there appeared in America a translation of The Silicates in Chemistry and Commerce by the late W. and D. Asch of Germany. The book indicated possible relationships of silicon to carbon and pointed to a vast field for silicon research. Some years ago, a producer of plastics became affiliated with a manufacturer of plate glass to improve and promote the fabrication of laminated glass. Another glass manufacturer recently organized a company with a leading manufacturer of organic chemicals, including plastics. From what has been going on in both these organizations, reading between the lines one might venture to conjure up silicon-substituted plastics which would approach glass in properties and which might be capable of fabrication into units of any desired size and shape. The wallboard of tomorrow may be a silicon-carbon plastic and may become the perfect bridge between the divisions of inorganic and organic chemistry. Present plastics scratch too readily. Although they do not flame up, they are combustible. Will the silicon-substituted plastics overcome these defects? Time will tell. Will silicon-substituted rubber be the realization of the age-long dream of malleable glass? Who knows? Such things might happen.

Glass construction in the factory and office building is already a foregone conclusion. Although the various principles set forth for the home of the future may not all apply to factory or office building construction, many of the principles might be utilized. The ease with which glass tile can be set and the low cost of keeping it clean are in its favor.

Should you be one of those who do not want to apply glass directly, you might wish to finish the exterior with wallboard. Although wallboard is prepared in various ways, one of the types owes its value to the water-glass binder which is used.

IV. Insulation

Foam glass, to which reference has been made, is not porous and there is no condensation of moisture. As an insulating material, it will become increasingly valuable. With improvements in external nature, it may compete in the construction field. Perhaps it will also find its way into hollow tile.

Glass wool has been used much longer as an insulating material. Although it is porous and tends toward moisture condensation, it has been treated to furnish rigidity and can be used in bonded block form. It is constantly being made lighter. Although it originally weighed about 4 lb. per cu. ft., it is now available at a weight of only $^1/_2$ lb. per cu. ft. The fact that the 4-lb. material in a battleship reduces by 60 tons the weight of the vessel implies that building construction of the future might be lighter because of the low weight of this insulating material.

A 4-inch layer of glass wool has the heat insulating value of a 14-ft. concrete wall. Certainly glass insulation, whether of one type or another, will result in a marked lowering of heating costs. Also there will be the advantage of nonflammability and the other possibility of electrical insulation with nonflammable woven glass tubing. Glass fabrics will find increasing use in motor generators, in cables, and as battery insulators.

Insulation applies not only to heat and electrical conductivity but also to sound. Glass wool and foam glass will find increasing application in the field of acoustics.

Insulating glass will be a factor in future colonization. In the temporary housing provided for our Armed Forces in the arctic regions, porous glass materials, especially wool, are employed to keep out the intense cold (see Fig. 2). Motor trucks are also insulated. The future

FIG. 2.—Glass wool insulation in the arctic shelters provided for our Armed Forces.

may see towns and cities rise in the regions of perpetual snow, where, by keeping the intense cold out of man's habitation, new occupations and industries will develop. If it is necessary to depend on fish oil for lighting, a permanent glass-cloth wick may replace the combustible cotton wick in the lamp.

Buildings of the future will be insulated not only against heat and electricity, but will be vermin- and rodent-proof.

V. Radiations

Allusion has previously been made to radiant heating from electrically heated metallized glass surfaces. In the factory and the home of the future, gaseous, liquid, and solid fuels will gradually be replaced by other methods of

heating. The sun radiates an amount of heat toward the earth each hour which is equivalent to the heat produced by twenty-one billion tons of coal. Certain glasses, such as chrome greens, become hot when they are exposed to infrared rays. Will the heating plant of the future be a chrome green boiler upon which solar heat is concentrated through large glass lenses? Theoretically this could be. Perhaps it will be. Heat-absorbing boilers could be distributed in such a fashion that for a given geographical area there would always be a sufficient average solar radiation to produce a fixed amount of power. This power might be used locally for steam production or to generate electricity which might be conveyed to other parts.

Radiant heat from infrared lamps has been used industrially for drying pottery and baking lacquers and enamels. The lamps are used in the laboratory in evaporation procedures. We may cook the evening meal of the future in glass dishes by radiation from above with lamps that will replace the gas flame or the electric hot plate of the present. Specially colored containers might be on the dinner table in the focus of heat beams so that their contents could be warmed or cooked on location. As some types of glass are transparent to infrared rays, their contents could be heated by radiation, sealed, and kept sterile for future use. Where certain rays are harmful to food ingredients, such as vitamins, foods could be stored in containers which absorb the harmful rays. In fermentation industries of the future, the limited laboratory practice of developing a culture to a certain point in glass and then arresting it by ultraviolet rays to which the glass is transparent may be applied. Certain molds cannot grow in the light of certain colors. This principle might be applied to glass containers, or as colored coatings, to prevent mold formation in the containers. Desirable industrial molds, e.g., molds which produce citric acid, might be cultivated under favorable radiations. For man himself, infrared radiation may serve for its therapeutic value and perhaps provide a future free from pains and aches.

Ultraviolet light, already mentioned for fermentation control, will be utilized more extensively after the war in the factory and in the home. The very short waves from quartz mercury-vapor tubes or high-silica glasses will be reflected by suitably designed aluminized glass units toward ceiling or wall areas coated with durable fluorescent materials. Instead of the present mercury-vapor lamps, with the fluorescent material on the interior, we shall have fluorescent surfaces where we want them and send the ultraviolet from the lamps to the areas to be illuminated. The violet rays will sterilize the atmosphere of the room and destroy aerobic bacteria, thus insuring better health. Although we should expect less dust with increased glass construction, it will be a consolation to know that the dust which is produced will be sterilized. The sterilamp will be used in refrigerators to preserve the contents longer. It is already used to tenderize meat.

Sun lamps must transmit a different kind of ultraviolet. The short waves of the sterilamp and the quartz mercury-vapor tube would produce serious skin burns or irritations. With a suitable glass which will transmit ultraviolet above the harmful waves, we may enjoy sun baths in the home and obtain a healthful coat of tan regularly, even on cloudy days. These lamps are already in use in Army camps and there is little doubt that we shall all want to enjoy their benefits after the war. They can be operated on the regular lighting circuit like ordinary lamp bulbs.

The sun lamps and ultraviolet lamps already discussed have clear, colorless, or etched glass tubes or bulbs. There is, however, an ultraviolet lamp which is so dark that it appears black. It does not transmit visible light but lets the longer ultraviolet through. This lamp illuminates certain types of fluorescent materials. It is employed to light fluorescent carpets in the aisles of theaters and has been used in various ways in the war. A part of the artistic effect in the home of the future may result from the use of such lamps in dark rooms.

One might imagine all sorts of seemingly amusing applications of radiations. Suppose that the hungry babe in the crib wants a bottle at night. A bottle may be developed which will consist of different types of glass in the upper and lower halves. The lower portion might be a heat-absorbing glass to warm the contents by an infrared beam. The upper half might be an ultraviolet-transmitting glass to sterilize the contents. These beams would be controlled by a thermostat to regulate the temperature of the milk. The baby's cry would actuate a sound-sensitive relay, which would bring the bottle to within the baby's reach on a mechanical arm. When the bottle and contents dropped to a certain weight, the arm would remove the bottle and a second or even a third arm could swing into place. This may sound like the inventions of one of our well-known cartoonists, but it is not impossible.

Factory lighting may undergo a revolution. We already have a thousand-watt mercury lamp no larger than a cigarette. It yields ten thousand candle power, and yet this is insignificant compared with the floodlights which are in use in the war and produce two hundred million candle power. Just how we shall utilize these sources of intense illumination is difficult to imagine, but we may rest assured that the illuminating engineer will bring the high-powered lamp to practical use.

There will be efficiency studies in our manufacturing plants, and we will learn under just what kind of light and intensity employees can do their best work. There will be one color of light for one operation and a different color for another operation. The idea of applying the same type of lighting to all purposes will be a thing of the past.

In our homes we shall eventually enjoy anything from sunrise to moonlight. With air conditioning and thermostatic control, atmospheric conditions may vary from the tropics to the arctic. Any type of vegetation should be possible in the sun parlor or the conservatory. The temperamental individual who cannot be satisfied will be a rare exception.

Although the home will be attractive and afford variety, our highways will become more monotonous at night. High-speed motorcars with increasing air navigation, will demand definition and the elimination of distractive lighting. This will mean the almost universal use of the monochromatic sodium-vapor lamp or similar color-producing lamps which furnish the desired illumination.

VI. Hot Water and Service Lines

Water heaters have almost invariably contained copper coils. In many districts where the chemical nature of the

water is unfavorable, copper is attacked and the coils have a comparatively short life. Chemicals also attack brass and iron lines. Certain organisms corrode iron water pipes. In the laboratory we unhesitatingly boil water in chemical flasks. We use condensers with steam or hotter vapors on the interior and cold running water on the exterior of the condenser tubes. New special glasses can be heated on ice with a blowtorch. In the war emergency, glass tubing has replaced metal in industries where it had not previously been employed. Pipe lines, condensing columns, and evaporators were in use in chemical plants before the war, but the thought of using glass in milk processing and food industries came later. Tubing and pipe are available in a variety of compositions and sizes, even up to several feet in diameter. The smaller diameters have been manipulated at will in the laboratory, and the expert laboratory glassworker has made vacuum bottles and most intricate laboratory apparatus from larger tubes. Glass tubing is now available for the plumber and the pipe fitter. With torches they can bend it with some practice and experience. They can produce flanges and apply gaskets. They can attach metal joints and valve outlets. They can do about anything that is done with metal pipe or tubing except to hammer it into shape and give it some of the rough treatment which metal receives. If the plumber and the pipe fitter will learn a new and somewhat more careful technique and if the manufacturer and householder will learn the peculiarities of the new material, glass pipe lines will enter factory and home. Corrosion problems will practically disappear, and there will be a cleanliness of service, especially in industrial processing, which was never possible in opaque pipe lines. Types of glass are made which should serve well in gas-fired water heaters or which, when metallized, might be heated electrically. The outer jacket of a water heater could also be glass, and the storage tank might be made of glass. Now that electric welding is possible, one should expect to build anything of glass where parts could be fitted together, provided he chose a type of glass which would sufficiently withstand temperature changes required for the welding. Naturally, the fabricated unit should be annealed and probably tempered.

A glass pump provided all the water that was used in the house of glass during the two years of the New York World's Fair. These pumps are in use in industry today and are in such demand that they cannot be produced rapidly enough. Glass pumps will come into increasing use in industry and will eventually enter the home. The rural or suburban residence of the future may draw its water supply from wells through glass pumps.

VII. Glass Containers

Studies on the bottle and the jar have been made by the larger manufacturers and by their associations. Our knowledge of food chemistry is advancing to a point where the nature of the container assumes importance. A bottle or jar of the future will be selected on the basis of the food which it shall preserve. One type of glass may protect vitamins, whereas another may not. This statement refers both to the color and the chemical composition of the glass. One glass may serve better than another for stabilizing the fats in the food content. A particular color might prevent the development of molds. The old slogan, "Buy it in glass and see what you buy," may have to be changed. Perhaps we shall even use black glass for some foods to insure the same darkness which they enjoy in tin containers. From what has already been said concerning radiations, we might select a container which absorbs heat rays and cooks the contents, or another which will transmit ultraviolet and permit their sterilization. The idea of applying one type of glass to all container purposes will change.

VIII. Optical Glass

In the optical field, the postwar period will bring important revelations. In photography we shall have a lens available whose index of refraction is much greater than was formerly possible and whose dispersion is such that we shall not only be able to cover a wider field, but also to cover it with greater clarity and speed. These changes may not be confined to photography. They may affect the motion picture. The writer recalls a theater in London where in 1928 he saw a panoramic motion picture entitled "Napoleon" which was projected simultaneously from three machines so synchronized that the effect of vast space on the screen was incredible. The scene in which Napoleon crossed the Alps with his army was one never to be forgotten. The motion picture of the future may be projected on a screen which is concave laterally and so wide that a similar effect will be obtained by a single projection machine. Besides, color photography, with the use of polarizing media, will give us a three-dimensional picture.

The fluoride treatment of lenses will become more common. Reflections will be a thing of the past, and clarity and high-speed transmission will encourage even the amateur.

There will be a great variety of goggles. The war is teaching us how to see and what to look for. There might be red goggles for one purpose; dichroic glasses for another; special lenses to keep out the ultraviolet; others to prevent glare. The latter will evolve from the old smoked glass which was used to view an eclipse to a special one for this type of welding and another for that, depending on the color of the glare and what must be eliminated to insure clarity of vision and protection of sight. Dimming glasses with all kinds of absorption will be developed, e.g., a recently announced glass which absorbs the yellow sodium vapor in welding where such incandescence obtains.

To correct abnormal vision, there will be an increasing use of contact lenses. America has developed the highest degree of skill in the making of artificial eyes. Our boys who are unfortunate enough to lose an eye in the service will at least be able to match the good member which remains.

IX. Radio and Telephony

Here the secrecy of war development has been profound. Undoubtedly developments have come that will minimize extraneous interference and insure clarity of reception. We may look for improvements in radio bulbs or tubes and to the extension and more general application of television. We may even have transmission in natural color. The researches on communication between divisions of the Armed Forces will bear fruit in the home of tomorrow.

The telephone may be a special wave set for each home,

and when the delicacy of selection is sufficiently refined, each subscriber may carry his telephone with him wherever he goes. The "walky-talky" of the Armed Forces will be the portable wireless telephone of tomorrow. We will have it in our motorcars. We will take it along on our vacations. We will use it as we cannot even imagine at this time.

And joy of joys! We shall be able to spot the solicitor and the book agent through a modified periscope and be rid of these irritations of today.

X. Transportation

Vacations will be revived after the war. The future two-week period might be spent on a round-the-world tour in a giant dirigible with plenty of clear bent glass to insure good views for all of the passengers. After crossing one of the oceans, the dirigible would load its airplanes with those tourists who wanted to make side trips, and they might go to country A or B or C, returning within a short time to the dirigible. These planes would also be provided with plenty of safe glass to insure a clear view. The glass construction would withstand unbalanced external and internal pressures, and automatic devices would insure the atmospheric pressure of sea level on the interior. For little jaunts near home, we shall go to the flat glass roof and enter a helicopter.

For those who are not air-minded, there will be new automobiles whose tops and sides are largely transparent laminated glass, and there will be huge motorbuses where the need for early entrance to obtain a good seat is a thing of the past. We shall be able to see clearly from all parts and in all directions. Passenger trains and ocean-going vessels will have a goodly portion of transparent streamlining. In our war planes we are using laminated plates that are three or more inches thick without distorting the view. There is no question of safety.

If one does not wish to see, but prefers to nap, he can wear a pair of goggles with circular parallel polarizing disks, which may be adjusted from clarity to blackness. In the compartments of trains and in the cabins of steamships, the goggle idea will be enlarged to a circular window with parallel circular panes, one of which on rotation will yield anything from full daylight to complete darkness.

XI. Science and Glass

In a sense most of our modern glass had its origin in the laboratory. Before 1880, only five of the chemical elements and their compounds were employed in optical glass manufacture. The physicist, Ernst Abbé, and the chemist, Otto Schott, by the close of the century, had added twenty elements and their compounds to the list. On the basis of atomic numbers, we have ninety-two elements. Of these all but about one dozen find their way into glass today. Laboratory ware has migrated to the kitchen and to the factory, but there still are glasses whose uses are limited to scientific application, e.g., the X-ray bulb which was once the small tube in a Roentgen experiment and now rates its voltage in the millions. It began as a scientific principle and is now used commercially. It is still, however, a scientific instrument.

Glass tubes of the laboratory became the ampoule guardian of serums and antitoxins, which are assured uncontaminated preservation. More rapid response to medication in the future will result through extending intravenous treatment. Laboratory glass has produced the special bottle which houses desiccated blood plasma of millions of donors and permits transfusions on the battlefield. These military needs of the day will become commonly available to all after the war, and the smallest village or hamlet should be able to care for the unfortunate in almost any emergency.

For the study of minute organisms we imported microscope cover glasses before World War II. We now make our own, and our future is independent. Our electron microscopes are giving us magnifications from ten thousand to one hundred thousand diameters. As they come into more general use, we shall have undreamed-of revelations.

There are special colored containers which preserve vitamins in food during their determination in the laboratory. There are others which admit ultraviolet. Laboratory apparatus can be made to meet practically any radiation requirement which experiment demands.

Thermometer glasses at one time required long aging to insure accurate temperature readings in the capillaries. A new annealing treatment stabilizes these quickly, and aging will no longer be necessary. Glasses of limited and definite thermal expansion will make glass the standard for gauges to insure accurate dimensions in manufactured products.

In the dye industry in Germany before World War I, twelve hundred scientists with Doctor of Philosophy degrees were employed. This necessitated a very large salary budget for research. Only about 5% of the researches were productive, yet the dye interests were able to pay dividends of more than 20% on their capital investment. The American glass industry has a greater scientific personnel than that of the glass industry of any other nation. The results of this service are too obvious to require elaboration. They will be more in evidence in the future. Science investments pay dividends. The American industry will continue to invest in research and control laboratories.

XII. Conclusion

World War I brought us to a realization of our shortcomings in the glass field. We met the emergency, and we progressed to a stage where we led the world in most things that are glass. In World War II, glass does not worry us. It has been only necessary to build more plants and provide more equipment. World War II has brought benefits which, as yet, are incalculable. Great leaders in the fields of plate glass, window glass, glass-fiber production, and art glass, realizing their hopelessness in Europe, have come to America. They are working with us. They will help us to enhance further the science, the art, the technology of glass in America and to insure American leadership for the future. The glass age has already begun. It will succeed the ages of stone, of bronze, of steel. America's glass products will help to rebuild postwar Europe and to restore happiness to its people. America's glass will insure postwar security at home.

Acknowledgment

The cooperation of many in collecting the varied information on which these predictions are based is gratefully acknowledged.

BENEFICIATION OF DOMESTIC TALCS*

By Sidney Gottlieb†

Abstract

Possible methods of beneficiation of domestic talcs, particularly flotation, are discussed. The commercial feasibility of flotation as a means of purification of domestic talcs is outlined.

I. Introduction

Customary milling practice in the talc industry consists of grinding and sizing; most sizing is a dry operation, because the air separator offers the most practical method of finishing a finely ground product. Little or no segregation of impurities is attempted because the differences in specific gravity and grindability between talc and the accessory impurities are negligible. Accordingly, gravity separation is of little value in producing a beneficiated product.

With the exception of flotation, the only type of beneficiation now in use is hand sorting and cobbing, which, of course, is applicable only to special deposits and is of no value when the impurities are locked in the finer sizes.

II. Magnetic Separation

Magnetite is the chief impurity in some talc-bearing products, particularly those of the Middle Atlantic States, and it can be removed magnetically. If liberation can be achieved without fine grinding, many of the dry magnetic separators on the market are suitable for use on talc. When fine grinding is necessary, the Ferro-Filter can be used to remove magnetic material from a wet slurry. If it is operated at 160 volts instead of the usual 115, it will also remove weakly magnetic minerals, such as garnet. Several North Carolina and Virginia talcs were treated by this method of wet magnetic separation, which method, when applicable, is practical and cheap. The cost of removing small amounts of iron magnetically from other nonmetallic minerals has been reported as ranging from 15 to 75 cents a ton, exclusive of drying.

III. Froth Flotation

When the impurities are other than magnetite, froth flotation is the most efficient and effective means of separating talc from the gangue minerals. The production of steatite-grade talc by this process is limited only by the degree of dissemination and by the quantity and quality of talc present. If the impurities are not liberated after grinding to 200-mesh, flotation is difficult, if not impossible. Also, if the talc molecule contains iron or lime as an isomorphous replacement in quantities higher than the specified 1.5%, it is impossible to produce a high-grade concentrate. If the sample, however, contains good-grade talc that can be liberated at 200-mesh or coarser, production is limited chiefly by economic considerations.

The methods, reagents, and other conditions for talc flotation have been thoroughly investigated. Clemmer and Cooke[1] have worked out the flotation of Vermont talc from magnesite. Norman, O'Meara, and Baumert[2] have reported a complete series of tests on talc from the Gouverneur, New York, district. Other investigations have been made by Engel and Shelton[3] and Norman and Ralston.[4]

Talc has an inherent floatability so great that it will be floated by any of the frothing or collecting agents ordinarily used. Consequently, the only reagent necessary is a frothing agent to aid in bubble formation. Pine oil is excellent for this purpose. Other good frothers are cresylic acid and many of the alcohols. The amount of frother must be regulated because a deficiency permits loss of talc in the tailings and an excess tends to produce low-grade concentrates. Usually pine-oil froths are voluminous and may be modified with kerosene for easier handling as well as increased carrying power. Proper balance of the two must be maintained.

Many talcs contain accessory minerals that may be depressed automatically. Those that are carried over mechanically in the rougher flotation can be dropped by recleaning the froth. In other talcs, depression of the gangue minerals must be emphasized. Dispersion agents such as sodium silicate or some of the complex sodium phosphates are effective depressants when their need is indicated. The quantity used need not be as precisely controlled as the frother, as an excess does not depress the talc and the resulting change in pH does not affect the flotation. Talc floats readily with pine oil through the pH range of 5.0 to 12.

The quantities of reagent necessary are small; two or three tenths of a pound of pine oil per ton of feed is usually sufficient. An equal amount of kerosene will also suffice. If a depressant is used, 2.0 lb. of sodium silicate per ton would be a typical amount.

Pulp densities in the flotation machine range as high as

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This investigation was conducted at the Southern Experiment Station, Bureau of Mines, United States Department of the Interior, in cooperation with the University of Alabama, Tuscaloosa, Ala.

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[1] J. B. Clemmer and S. R. B. Cooke, "Flotation of Vermont Talc-Magnesite Ores," *U. S. Bur. Mines Repts. Investigations*, No. 3314, 12 pp. (1936); *Ceram. Abs.*, **16** [2] 74 (1937).

[2] J. E. Norman, R. G. O'Meara, and F. X. Baumert, "Froth Flotation of Talc Ores from Gouverneur, N. Y.," *Bull. Amer. Ceram. Soc.*, **18** [8] 292–97 (1939).

[3] A. L. Engel and S. M. Shelton, "Ore-Testing Studies: Metallurgical Division Progress Report No. 36," *U. S. Bur. Mines Repts. Investigations*, No. 3484, 33 pp. (1940); *Ceram. Abs.*, **19** [6] 148 (1940).

[4] J. E. Norman and O. C. Ralston, "Conditioning Surfaces for Froth Flotation," *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1074; *Mining Tech.*, **3** [3] 16 pp. (1939).

25% solids. A lower pulp density may give higher-grade concentrates but, of course, at the expense of decreased plant capacity. The froth from the rougher flotation often requires recleaning, the number of cleaners depending upon the quality of the feed and the product desired. Lower pulp densities in the cleaners than i n the rougher cells are usually helpful.

The preparation of feed for flotation depends on the ore. Even −20-mesh talc can be floated if the talc is platy and liberated. In general, however, the size to which talc must be ground for flotation feed is dictated by the size at which it is liberated from the accessory minerals. Grinding must be wet, as dry grinding seems to smear talc over gangue mineral surfaces more than wet grinding. Wet ball milling in a porcelain-lined mill with porcelain balls or flint pebbles is the best method of preparing talc for flotation without contamination.

Flotation results depend largely on the quality of ore used. If the quantity of impurities is high, recoveries will be low because the necessary repeated cleanings will cause too high a loss in the middling products. In general, any talc which requires more than two cleaners or yields a low percentage of recovery will be uneconomical to process. This may be offset by low mining or transportation costs. There is no escaping the fact that each deposit is an individual mineral-dressing problem and must be treated as such.

IV. Laboratory Flotation Testing

In the current investigation the number of samples submitted for testing was too great to permit a lengthy series of tests on each sample. Accordingly, a standard procedure was adopted for testing (see Fig. 1). Although a few fair prospects may have been rejected because of this, it is doubtful if any of them were worth while. The limits placed on the results were not hard and fast, and any samples that showed promise were investigated further.

The details of the testing procedure are as follows:

The sample was crushed and a representative portion was cut out and ground through 20-mesh. From this, a 125-gm. charge was wet-ground in a small pebble mill in short stages. The −200-mesh material was screened out after each stage. Following the reduction stage, the excess water was filtered out and the charge was floated in a 250-gm. mechanical-type machine after a brief conditioning period with pine oil. The pulp consistency was approximately 14% solids. Three-tenths of a pound of pine oil per ton was used as a frothing agent. As control of the froth in a small batch operation is not particularly necessary, no kerosene was used. Because of the thin pulp, sodium silicate was not essential to production of high-grade concentrates.

The rougher concentrate from tnis cell was cleaned in a 500-gm. cell of the same type. The products were filtered and assayed chemically. If the products were satisfactory, other tests were made on the cleaner concentrate.

If the talc appeared to have possibilities as a steatite material, a sample large enough to provide 50 lb. of concentrate for body tests was treated. The procedure followed the flowsheet in Fig. 1. The talc was crushed to pass 10-mesh and then was ground in batches in a large porcelain-lined ball mill with flint pebbles. Pulp consistency in grinding was 50% solids. Milling time was controlled to give the particle size necessary for liberation of the locked talc. By feeding the ground batches into a conditioning tank agitated with a high-speed mixer, a continuous flow into a unit flotation cell was obtained. Reagents were added in the conditioner. Rougher flotation was carried out in a pulp of 15% solids. Cleaning

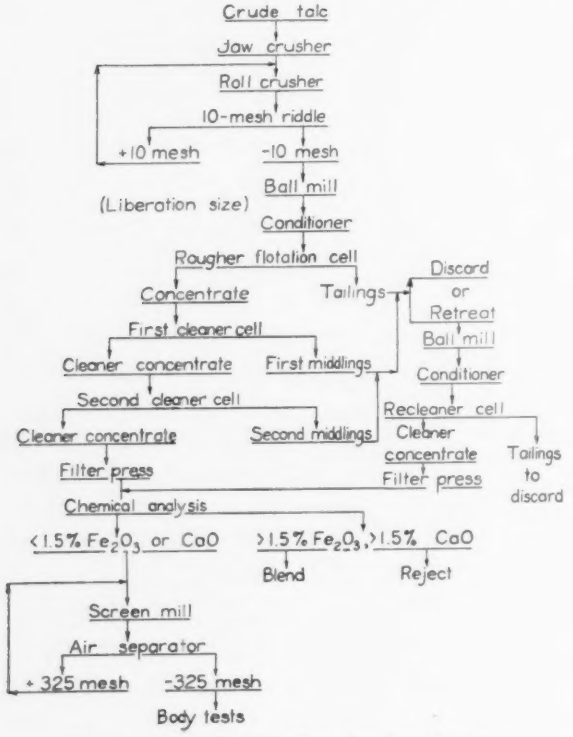

FIG. 1.—Flotation flowsheet for steatite talc.

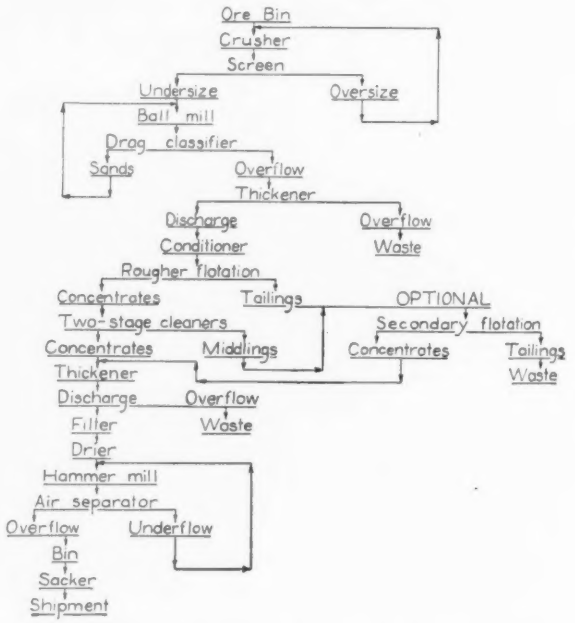

FIG. 2.—Flowsheet for talc flotation plant.

was accomplished in a second step by returning the concentrates to the conditioner by hand.

V. Plant Practice

Figure 2 shows a suggested flowsheet for a plant producing talc of steatite grade by flotation. Naturally, it is not a rigid setup, but would be modified to meet the requirements of the product. Under wartime conditions, the relative merits of one type of crusher, classifier, flotation machine, etc., are subordinate to the availability of equipment. Recommendations, therefore, are hardly in order.

The number of cleaners and reagent charges and the amount and type of re-treatment must all be worked out to fit the ore.

DOMESTIC TALCS*

By T. A. Klinefelter†

Abstract

Talcs of high grade are needed to manufacture insulators suitable for the high-frequency fields of radios used by the armed forces. The domestic supply comes largely from California. To see what further high-grade talc reserves the country possesses, the Bureau of Mines has made a survey of all talc-producing centers. The survey includes several more western states, one or two in the central section and several in the east. The specifications and testing procedures are described, and the results and general findings are discussed.

I. Introduction

There has been a most encouraging trend in the whole ceramic industry during the last decade, which is exemplified by the search for new raw materials. Many factors have been at work, e.g., (1) recognition of the increasing scarcity of high-grade materials, particularly those used for fluxing, and (2) the attempt to modify or change certain undesirable characteristics inherent in the usual materials. With the aid of new tools and methods developed during the same period, most gratifying results have been achieved. One of the most interesting developments of this type has been the so-called steatite porcelain now widely used for insulator purposes. Talc, steatite, and soapstone have been employed to a certain extent in the ceramic industry for a long time, but not on a large scale until comparatively recently. Although the many merits of talc were recognized quite early, it was difficult to obtain material of the desired purity, of uniform grade, and in sufficient quantity. Great quantities of talc are available, but most of it is considered to be of low grade by the ceramist.

Most producers are not really interested in the high-grade market. About 300,000 tons of talc are consumed annually in this country, and the market is growing. It is largely, however, a nonceramic market and from the producers' standpoint a far easier one to supply. Talc is used mainly for fillers for paints, rubber, and paper. For such purposes, the usual impurities may be ground up along with the talc, and the whole is quite satisfactory. It is all dry-processed and readily handled; the main care is in supplying the desired degree of grinding.

II. Talc for Ceramic Use

The ceramic market, however, has been steadily increasing from an almost negligible amount in 1930 to about 50,000 tons in 1940. Probably only 5000 tons of this 50,000 were used in 1940 for insulator work. In 1942, however, the amount taken for this purpose was possibly more than doubled. Before the war, we imported about 20,000 tons annually from France, Italy, Japan, and Manchukuo. Much of this was high-grade and some of it undoubtedly was used for electrical porcelain. For such use we are consuming larger quantities than ever.

Few of the larger talc deposits contain much high-grade material. Such material may be recovered by hand-sorting and the remainder may be processed for other purposes, but to maintain a high production level more and more deposits must be worked. If not, wet processing will be required to raise to standard as much of the lower-grade material as possible.

The survey conducted by the Bureau of Mines, United States Department of the Interior, in cooperation with the University of Alabama at the instance of the Army-Navy Joint Steatite Committee, was primarily to examine talc from producing deposits. Naturally, a certain amount from prospects and claims was evaluated also, but the bulk of the work has been carried out on talcs being produced for one purpose or another.

III. Location

Geographically, production of high-grade talc for steatite insulators has centered in California. Most of this grade in previous years had come from a single mine. A number of small mines in California, however, can produce some high-grade talc. Scattered deposits in the state also contain low-grade talcs which cannot be brought to grade at a reasonable price. Nevada deposits also are being used. The Nevada talcs are much like certain California talcs. There are small deposits of high-grade talc in New Mexico and some larger deposits in Montana.

With the tonnages in sight, the situation can be handled for a time without resort to beneficiation. Transporting the western talcs to eastern steatite manufacturers costs more than the price at the shipping point.

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The main eastern talc production centers around the New York district. Almost half of the whole domestic talc production has come from this section.

The next largest eastern producers are in Vermont, North Carolina, and Georgia; the Georgia talcs are obtained from a line of deposits in the Appalachians. None of the current producers are marketing material for insulators.

Because of transportation facilities and low freight rates, eastern talc should be the most satisfactory for manufacturers. Several reasons, however, lie behind the lack of eastern production:

(1) The market is so small that most eastern producers have not cared to bother with it, even if their talc was of the required quality.

(2) Until the war shut off imports, high-grade talc was readily available at reasonable prices in New York City or Philadelphia.

(3) Very little eastern talc can be used unless beneficiated (although small amounts may be employed if mixed with high-grade talc), for eastern talcs tend to be high in tremolite if from the New York district or high in iron if from along the Appalachians.

IV. Geological History

Talcs, using the term in the broad sense, are alteration products and may be derived from either igneous or sedimentary rocks. The high-grade material, however, comes from altered limestones and dolomites. The principal California deposits are lenses occurring along the contact lines of the dolomitic limestones and the country rock, which is diorite. This is typical. The change from other magnesium minerals, such as tremolite or enstatite, is assumed to have been brought about by carbonated waters, as talc occurs so frequently in contact with limestone. As talcs form from a variety of rocks, the types of impurities found also vary, and the talcs from the different producing centers all carry more or less characteristic mineral impurities. Thus the California talcs contain chiefly carbonates; Nevada talcs contain chlorite also; New York talcs contain tremolite; and the deposits along the Appalachians tend to be associated with iron minerals.

V. Mineralogical Characteristics

Talc minerals with a foliated or loose texture are usually called talcs and those of massive dense structure are called steatites or soapstones; the latter term implies an excess of impurities. When the talc minerals are ground, the texture is ordinarily platy or foliated, fibrous like serpentine, or granular. The foliated talc is usually the softest to the feel and the granular talc is the hardest. In flotation processes, the foliated types take longer to clean than the granular types. No published data on die-pressing characteristics are available. Each type probably has certain desirable characteristics in the general processing, and blends undoubtedly may produce bodies with better characteristics than any one type.

In checking over brands in accepted use in the industry, we have found that these talcs seldom contain more than 2 to 3% of undesirable minerals, sometimes hardly more than traces. Such talcs can be controlled more easily, especially if no blends are used. A great many talcs that might make equally good insulators are eliminated, however, and if production increases, industry must take the situation firmly in hand and work along that line.

VI. Testing Procedure

To find suitable talcs, the Bureau examined standard brands and has followed specifications based on the findings. When certain talcs in use were not up to these standards, it was felt best to follow the regular standards and suggest these talcs as blends.

The iron limits are fairly definite, for if 1.5% Fe_2O_3 is exceeded the color becomes too dark. A routine assay for iron is made accordingly. The War Production Board uses this limit.

The lime limits were set at 1.5% after some shifting. An assay is also made for the CaO content. These limits are not particularly satisfactory. Lime in a ceramic body acts as a flux which affects the vitrification characteristics, but the fluxing characteristics of the lime vary with the mineral that introduces it. As the standard brands contain lime chiefly in the form of carbonates, with tremolite as a minor or missing impurity, the 1.5% limit developed on that basis is reasonably accurate for that type of impurity. When the lime occurs as tremolite, however, the 1.5% limit may be exceeded and the talc may be still too refractory for the standard body test. Evidently a 1.5% assay cannot be followed too rigidly. The War Production Board also adopted the 1.5% limit.

Alumina limits were not established by the Bureau, because sufficient data were lacking. The War Production Board has indicated 4%, and that is probably safe. The Bureau has depended upon a petrographic examination to show whether or not alumina-bearing minerals were present. If the total of mineral impurities exceeded 5 to 10%, it was a basis, then, for Al_2O_3 assays. Although clay introduces Al_2O_3, chlorite is the chief mineral introducing it. Chlorite is usually as soft as the average talc and produces a body of much the same characteristics as talc, so there is a question as to where the limits may lie. Shrinkage may be the main trouble-causing factor. As standard brands sometimes carry as much as 2% Al_2O_3, the 4% limit is probably correct.

When the impurities exceed the standard limits by small amounts a froth-flotation test is given. This is explained in detail by Gottlieb,[1] but it should be emphasized that it is a standard test of little variation; he does not attempt to work out the best methods and reagents for any particular talc. One reagent and a standard procedure are used. Any talc that will yield to beneficiation will be indicated in the test used.

An abrasion test is now standard routine. The apparatus used is a machine developed for testing dentifrice abrasion.[2]

The main chance of error seems to be in the degree of fineness of the material. A 200-mesh talc, for instance, may give twice the abrasion loss that the same talc does through 325-mesh. Naturally, one will vary considerably in any given mesh material, particularly from one talc to

[1] Sidney Gottlieb, "Beneficiation of Domestic Talcs," see this issue, p. 223.

[2] R. W. Smith, "Machine for Testing Dentifrice Abrasion," *Ind. Eng. Chem., Anal. Ed.*, **12**, p. 419 (July 15, 1940).

another, depending upon whether the structure is platy, fibrous, or granular. With so large an error, we report in general terms only—soft, standard, and hard—and allow plenty of leeway in all cases. It, however, is quite surprising how regularly the talcs and other materials fall into line. Other ground products such as limestone and fluorspar were checked, and results are comparable with their hardness.

The test has not been used as an evaluation factor for rating any of the talcs, as there are no published data to show how serious a factor the hardness of the talc may be in processing. The results have been given out for information purposes only.

So long as the mineral impurities are below 2 to 3%, the abrasion losses are no more or less than the standard, regardless of the structure.

A final test on the raw material consists in firing a small plaque to 2300°F. (cone 10) to note the color. Excessive shrinkage or fusibility, etc., also give some added information.

In general, the tests on raw materials (see Fig. 1) eliminate certain talcs and narrow the number for the final testing when incorporated into a body. Frequently, talcs or beneficiated products that meet these raw-materials tests fail on the final tests, where certain body and electrical characteristics must be met.

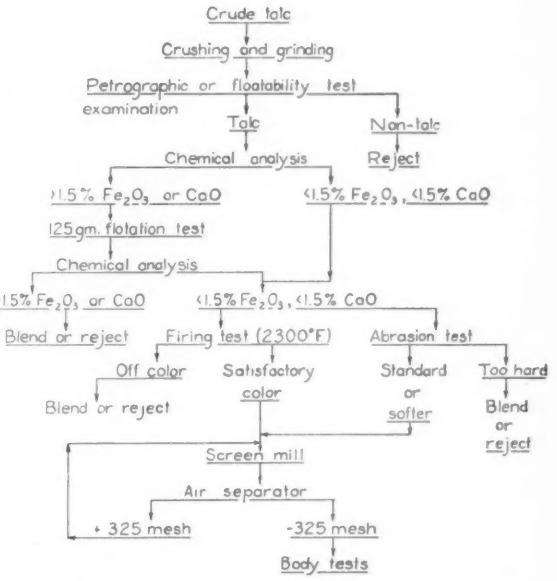

FIG. 1.—Testing procedure for steatite talc.

Acknowledgment

The talc survey was conducted under the general supervision of O. C. Ralston in the early stages and later under S. M. Shelton. Acknowledgment is due Will H. Coghill, supervising engineer of the Southern Experiment Station, U. S. Bureau of Mines, Tuscaloosa, Ala. The following persons worked on general phases of the program: T. A. Klinefelter, R. G. O'Meara, Richard W. Smith, Sidney Gottlieb, and Glen C. Truesdell. Ellis E. Creitz made the chemical analyses, and Louis H. Berkelhamer made the petrographic examinations.

PETROGRAPHIC STUDY OF DOMESTIC TALCS*

BY LOUIS H. BERKELHAMER†

ABSTRACT

A petrographic study of 175 domestic talc samples was made with interest centered chiefly on talcs of radio ceramic grade to meet specifications of 1.5% CaO, 1.5% Fe_2O_3. Samples from California, Nevada, Montana, New Mexico, Texas, New York, Vermont, Rhode Island, Maryland, Virginia, North Carolina, Georgia, and Alabama were examined. The commonest impurities found in talcs were alkaline-earth carbonates and tremolite; less common impurities included quartz, chlorite, serpentine, magnetite, and limonite (free and as stain). The California talcs were dominantly carbonate-bearing, whereas the New York talcs were dominantly tremolite-bearing. Carbonate-bearing talcs were more amenable to beneficiation by flotation than tremolite-bearing talcs. Low CaO did not necessarily imply low impurity, as high percentages of mineral impurities were present with low lime content.

I. Introduction

The petrographic study reported in this paper was incidental to a broader investigation by the U. S. Bureau of Mines concerning domestic talc for radio ceramics.[1]

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This report represents the results of cooperative work between the Bureau of Mines, United States Department of the Interior, and the University of Alabama. Published by permission of the Director, Bureau of Mines.

† Associate mineral technologist, Southern Experiment Station, U. S. Bureau of Mines, Tuscaloosa, Ala.

[1] (*a*) T. A. Klinefelter, R. W. Smith, R. G. O'Meara, and G. C. Truesdell, "Talc in Radio." Paper presented at A.I.M.M.E. Industrial Minerals Division meeting, Bethlehem, Pa., October 24, 1942; to be published in *Mining Tech.*, July, 1943.

(*b*) T. A. Klinefelter, "Domestic Talcs," see this issue, p. 225.

(*c*) Sidney Gottlieb, "Beneficiation of Domestic Talcs," see this issue, p. 223.

(*d*) Sidney Speil, "Physical Testing of Talc for High-Frequency Ceramics." Paper presented at Forty-Fifth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 20, 1943 (Materials and Equipment Division); to be published later.

The petrographic work was to act chiefly as a guide to distinguish talcs from nontalcs and to determine the mineralogical impurities in those samples classed as talc. The data on impurities, when arranged as to source of talc samples, follow a relatively definite pattern, in which California and New York are the principal sources with characteristics peculiar to each. Further, the amenability of undergrade talcs to beneficiation by flotation[1(c)] is almost predictable on the basis of known impurities.

(1) Mineralogy and Geology

The mineralogical and geological features of talc deposits are ably discussed in the literature,[2] and an especially good bibliography has been prepared by Gillson.[2(b)]

Talc is a hydrated magnesium silicate mineral having the theoretical formula $3MgO{\cdot}4SiO_2{\cdot}H_2O$. The commonest physical features are extreme softness, a greasy feel, and usually foliated structure. Although ordinarily foliated, talc also occurs in granular and fibrous massive forms and in a compact or cryptocrystalline state. The color ranges from silvery white or white to apple green, greenish gray, blackish green, tan, and brown, depending upon the degree of purity. The more common impurities associated with talc are dolomitic carbonate, a member of the tremolite-actinolite amphibole group, chlorite, serpentine, quartz, magnetite, and limonite.

Talc occurs widely distributed in crystalline rocks, such as schists and gneisses, and is especially common in dolomitic marbles. It is also abundant in metamorphosed basic igneous rocks, such as gabbro, pyroxenite, and peridotite.[2(c)] Gillson,[2(e)] in a review of the more important talc deposits, sets forth the the following conclusions: (1) Talc deposits are commonly lens-shaped and of irregular occurrence and extent. (2) They are replacement deposits in limestone, schists, gneisses, and altered basic intrusions. (3) The country rock of the talc was old and probably deeply buried at the time of the talc formation. Dynamic stress seldom was active during talc formation. (4) The solutions that formed the talc, whatever the original rock replaced, first formed amphibole, serpentine, or chlorite. (5) The solutions usually were hot alkaline emanations from granite, diorite, or the acid differentiates of basic intrusions.

(2) Optical Mineralogy

Talc is either monoclinic or orthorhombic, $\alpha = 1.539$, $\beta = 1.589$, $\gamma = 1.589$, biaxial negative with a small axial angle ($2V = 6$–$30°$, $2E = 9$–$48°$), appearing almost uniaxial at times. The cleavage is perfect in one direction (001), and the talc particles are colorless or transparent green under the microscope. Talc as observed microscopically occurs in plate, shred, or prismatic-acicular (long-fiber) form (Fig. 1). The plates may be coarse or fine, the latter generally appearing in aggregates. The shreds are fine-sized, short, and fiberlike and usually appear as felted aggregates; this shred form has been termed fibrous talc. The prismatic-acicular or long-fiber talc is a pseudomorph after tremolite and is best exemplified by talc from New York deposits.

II. Distribution of Mineral Impurities

In this investigation, the limits applied to impurities in talc of radio ceramic grade have been 1.5% CaO and 1.5% Fe_2O_3.* Inasmuch as these limits are a chemical specification, the quantitative petrographic determination of mineral impurities was based on an observed estimate rather than on more accurate methods, such as grain counts.

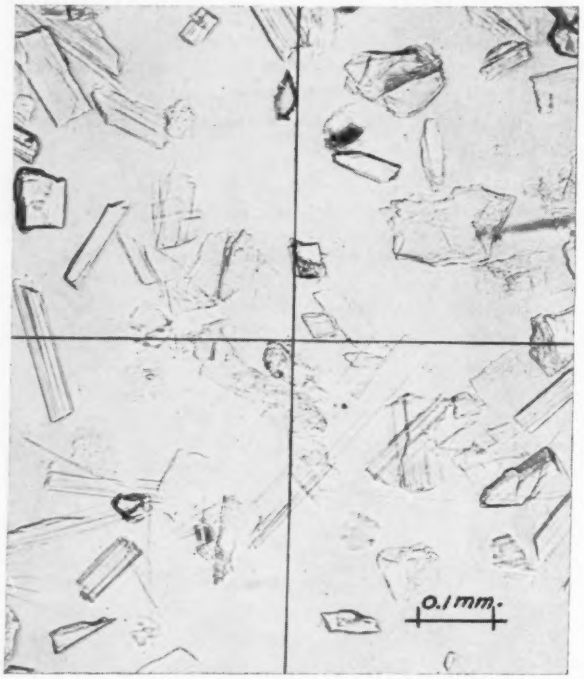

FIG. 1(*a*).—Plate and long-fiber talc.

Data were obtained on 175 talc samples, 152 of which contained 1% or more of mineral impurities. Carbonate (usually dolomitic) and tremolite (or tremolite-actinolite amphibole) are, in general, the commonest impurities, followed by chlorite, quartz, magnetite, limonite, hematite, rutile, zircon, apatite, serpentine, pyrite, and feldspar.

California, Nevada, and New York were the sources of most of the samples. California talcs, representing the largest group of samples studied, were dominantly carbonate-bearing; many were tremolite-bearing also. Of the latter group, however, the tremolite usually was accompanied by appreciable amounts of carbonate.

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[2] (*a*) E. S. Dana (W. E. Ford, editor), Textbook of Mineralogy, 4th ed., pp. 677–78. John Wiley & Sons, Inc., New York, 1932; *Ceram Abs.*, **12** [3] 126 (1933).

(*b*) J. L. Gillson, "Talc, Soapstone, and Pyrophyllite," *Seely W. Mudd Series, A.I.M.M.E., Industrial Minerals and Rocks, 1937*, pp. 873–92.

(*c*) J. L. Stuckey, "Talc Deposits of North Carolina," *Econ. Geol.*, **32** [8] 1009–18 (1937); *Ceram. Abs.*, **17** [4] 158 (1938).

(*d*) J. D. Burfoot, Jr., "Origin of Talc and Soapstone Deposits of Virginia," *Econ. Geol.*, **25**, 805–26 (1930); *Ceram. Abs.*, **11** [5] 322 (1932).

(*e*) J. L. Gillson, "Origin of Vermont Talc Deposits (with Discussion on Formation of Talc in General)," *Econ. Geol.*, **22**, 246–87 (1927).

* This has been amended recently to include 4% Al_2O_3 (WPB announcement, *Ceram. Ind.*, **40** [3] 47 (1943)).

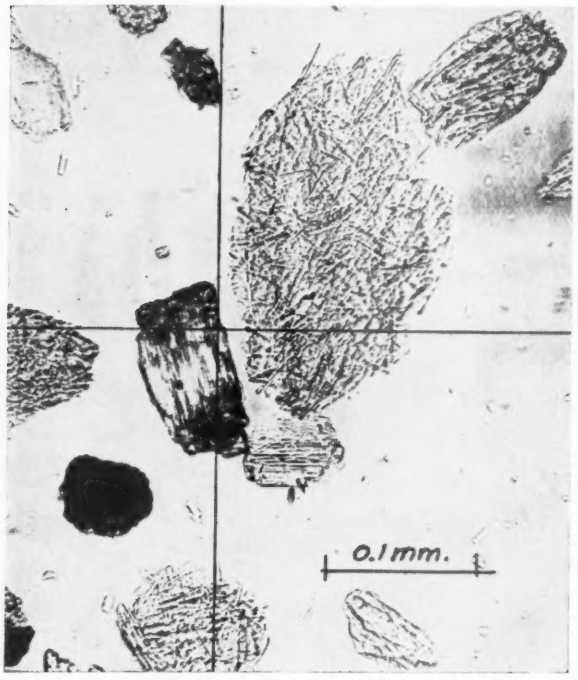

FIG. 1(*b*).—Tremolite needles as inclusions in talc flake.

The Nevada talcs, although slightly exceeding in carbonate impurities over tremolite, were characterized by the presence of chlorite in a number of samples.

From the remaining western states, Montana, New Mexico, and Texas, the number of samples was too small for a generalization, and the data merely indicated a prominence of carbonate impurities.

New York talcs comprised the second largest group studied and, in contrast to California talcs, contained largely tremolitic impurities with a smaller number of samples in which the chief impurities were carbonate. Unlike the California talcs, only two New York samples contained both carbonate and tremolite as chief impurities.

The few samples from Vermont and Rhode Island were chiefly carbonate-bearing. In the talcs from Maryland and Virginia, the principal impurities were predominantly tremolitic, although chlorite appeared in some samples.

In a small group of talcs from North Carolina, the impurities were chiefly carbonate, tremolite, or chlorite with no particular predominance of any.

No outstanding impurities were indicated in the Georgia samples, but the Alabama talcs appeared to be contaminated principally with iron-stain and free limonite and hematite.

III. Beneficiation and Impurities

In comparing the mineral impurities and the CaO and Fe_2O_3 contents of the talc samples before beneficiation with the results obtained by beneficiation of these samples, an interesting correlation was observed.

The beneficiation test was a flotation procedure that was standardized for routine testing[1(c)] and did not represent optimum treatment in every instance. This accounts for the few samples that failed to pass specifications, although they appeared rightfully to belong in the group that was beneficiated successfully. Special techniques doubtless would favorably alter the flotation results in some instances, but the results reported herein are comparative and indicate the relative ease of beneficiation of the samples.

(1) California Talcs

Of the 39 California talcs beneficiated, 16 passed specifications after treatment; 23 did not pass. Only 1 out of the 16 that passed had more than 1.5% Fe_2O_3 in the head sample; only 5 out of the 23 that did not pass contained more than 1.5% Fe_2O_3.

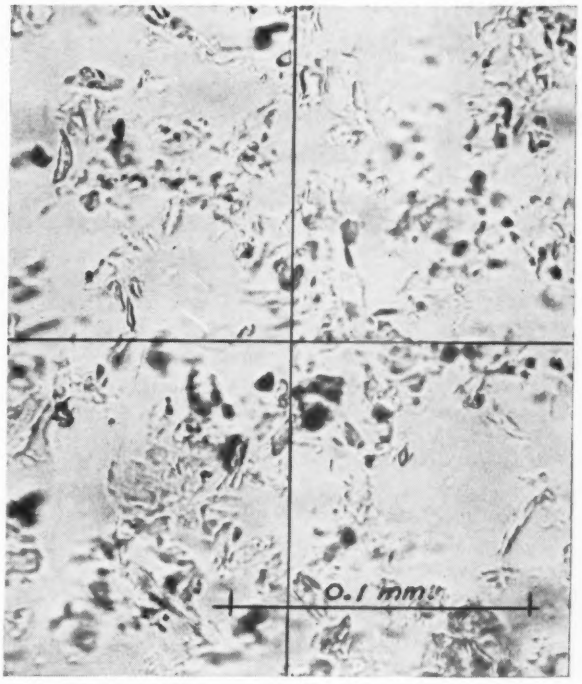

FIG. 1(*c*).—Shreds of talc, free and in aggregates.

Using an arbitrarily set value of 4.7% CaO obtained by inspection of the data, it was found that all but 1 of the 16 samples which were successfully beneficiated contained less than 4.7% CaO in the head sample. In contrast, of the 23 samples which failed to pass specifications after treatment, 17 contained more than 4.7% CaO. Of the 6 below 4.7% CaO, 4 had more than 1.5% Fe_2O_3.

High CaO present chiefly as carbonate alone was much easier to lower by the beneficiation procedure than CaO present as tremolite or mixtures of tremolite and carbonate. In the California talcs, carbonate, as well as splinters and needles of tremolite intimately locked in aggregates of fine-sized talc shreds and flakes (Fig. 1 (*b*)), were commonly found. In many instances, these were not liberated during grinding before flotation. This accounted for the few instances where carbonate or tremolite-carbonate impurities were present accompanied by relatively low CaO and yet the talcs did not reach specifications by beneficiation.

(2) New York Talcs

Of the flotation tests on 25 New York talcs, 12 were successful and 13 failed to produce concentrates that met specifications. In all the head samples tested, the Fe_2O_3 was below 1.5%.

Using the arbitrary value of 4.7% CaO, it was found that all but 1 of the 12 successfully beneficiated samples contained less than 4.7% CaO. Of the 13 head samples not meeting specifications after treatment, 11 contained more than 4.7% CaO.

Only 3 of the 13 talcs difficult to beneficiate contained impurities which were chiefly carbonate. In all cases, however, they were of comparatively high CaO content (over 17%).

In most instances, samples were successfully beneficiated whose impurities were chiefly tremolite, but which assayed relatively low in CaO.

(3) Miscellaneous Talcs

Of the 33 samples tested, 12 passed specifications and 21 failed.

Of the 21 that could not be beneficiated, all but 1 contained more than 1.5% Fe_2O_3. This sample contained 15.8% CaO and was the only sample in which the CaO content exceeded 4.7%. Of all the 21 samples, only 4 contained more than 1.5% CaO.

Of the 12 samples reacting favorably to flotation, all but 3 were only a little over 1.5% Fe_2O_3 (of the 3 samples, 2 were under 1.5% and 1 was 3.65% Fe_2O_3). Only 2 samples were over 1.5% CaO (1.7 and 5.3%).

In this group of samples where the Fe_2O_3 was high and CaO low as compared to the California and New York talcs, the chief mineralogical impurities in the majority of instances were carbonate and tremolitic amphibole. Samples, however, bearing chlorite, magnetite, limonite and iron-stain, hematite, and others as the chief impurities also appeared. The high Fe_2O_3 in most instances, where magnetite, limonite and iron-stain, and hematite are not already the chief or one of the chief impurities, is due to the prominence of these as secondary impurities.

IV. Discussion

As the complete details of this petrographic study of domestic talcs are not included herein, it is appropriate to point out a few pertinent facts. Samples essentially serpentine or containing large quantities of tremolite and quartz or carbonate have passed the chemical specifications of 1.5% CaO, 1.5% Fe_2O_3.* These samples, however, are poor when subjected to physical and ceramic testing. One and one half per cent CaO can account for approximately 11% tremolite or even more as other amphiboles appear containing Mg and Fe to replace the Ca of tremolite. Low lime content can also be misconstrued when it really represents the CaO present as dolomite or impure magnesites. Thus samples low in lime have been reported as refractory when compounded in bodies.[1(d)] On the other hand, talcs relatively high in lime have been reported as usable. The determination of lime in talcs apparently would be a more valuable criterion if it were described as lime in carbonate and lime in silicate. Petrographic observations of course clarify this, but on the basis of chemical analysis alone, total CaO content is only of speculative value except when it exceeds 5 to 10%.

The results of beneficiation tests would undoubtedly be amended to indicate more talcs available for use if more information were forthcoming from industry concerning the processing of radio ceramics from talc. Indications and the available knowledge of proper control in ceramic body composition have led to the belief that undoubtedly talcs of lime content higher than 1.5% can and are being used.

* Samples high in chlorite impurities will also pass these specifications, but generally can be detected by their Al_2O_3 content.

V. Summary

Many domestic deposits of talc meet the specifications 1.5% CaO, 1.5% Fe_2O_3 and are of apparently good radio ceramic grade.

The commonest impurities found in talcs were carbonate (usually dolomitic) and tremolite (or a tremolite-actinolite amphibole). The less common impurities included quartz, chlorite, serpentine, magnetite, and limonite (free and as stain).

The California talcs were dominantly carbonate-bearing and commonly revealed locking of carbonate alone and with tremolite needles in aggregates of finely felted flakes and shreds of talc. In most of the samples Fe_2O_3 was below the 1.5% limit.

The New York talcs were dominantly tremolite-bearing. In addition to the flake and shred forms of talc, New York deposits usually contained the long-fiber talc that is a pseudomorph after tremolite. In all instances Fe_2O_3 was below the 1.5% limit.

The miscellaneous talcs from states other than California or New York were dominantly either tremolite or carbonate-bearing, but were characterized by the prominence of high Fe_2O_3 content due to secondary impurities and an unusually low lime content (in most instances below 1.5%).

The beneficiation of talc by an adopted standard procedure of flotation gave the following results:

(1) The Fe_2O_3 content did not appear to be a workable factor. In all samples that were successfully beneficiated, the Fe_2O_3 was either well below or only slightly over the limit of 1.5%.

(2) In the California and New York samples, carbonate and tremolite impurities created the problem, whereas in samples from other sources, the Fe_2O_3-bearing minerals presented the difficulty.

(3) Carbonate-bearing talcs were more amenable to beneficiation than tremolite-bearing talcs. A value of 4.7% CaO appeared to be the approximate upper limit for the majority of talcs successfully concentrated by the flotation procedure used.

Low lime did not necessarily imply low impurity, as high percentages of mineral impurities with low lime content were present.

Acknowledgment

Chemical analyses were performed by E. E. Creitz and I. L. Feld, and beneficiation tests were conducted by G. C. Truesdell and Sidney Gottlieb of the Southern Experiment Station, U. S. Bureau of Mines.

ACTIVITIES OF THE SOCIETY

DISCUSSION AT BOARD OF TRUSTEES MEETING ON WAR STATUS OF CERAMIC ENGINEERS

PRESIDENT TROSTEL: Dr. Andrews' Committee on the Status of Ceramic Engineers with Selective Service Boards held a meeting in March and drew up a resolution[1] to be presented personally to Paul McNutt asking for direct reference to ceramic engineers in occupational bulletins. The resolution was accompanied by some supporting data to show the shortage of ceramic engineers in industry as developed in some surveys made by the universities. A. S. Watts made one of these surveys and Nelson Taylor made one.

The plan was to have a special committee appointed to present the resolution and the supporting data. A number of names were suggested for members for this special committee to carry the resolution to Washington, and to date the resolution has not been submitted because, first, some suggestions were made for changes in the details of the resolution and some slight changes in supporting data, plus the fact that several of the men approached for membership on this special committee were unable to serve. As soon as the committee can be appointed, the resolution can be taken directly to Washington and presented as the committee had planned.

J. E. EAGLE: What is the purpose of the resolution?

PROFESSOR WATTS: The Selective Service Board has persistently ignored ceramic engineers as such, and to gain any definite consideration in regard to exemption or deferment we must have the status of ceramic engineers recognized as engineers. At least that is what the Selective Service Board says, and it steadfastly refuses to classify us.

MR. EAGLE: Is that wording "graduate engineers"?

PROFESSOR WATTS: No. Ceramic engineers in industry. Of course each industry has to take up the individual case and ask for deferment on the basis of the importance and necessity for retaining the man. If we could obtain an acknowledgment from some government authority that ceramic engineers are essential to war industries, it would be very helpful, so here is the petition. (Professor Watts read the petition.)

SECRETARY PURDY: Mr. President, Dean Steidle and Nelson Taylor showed me last night a resolution which they have drawn up along this same line. If you do not mind, I think Dean Steidle would be very glad to propose it. He is going to present this to the Ceramic Educational Council.

DEAN STEIDLE: Mr. President and Gentlemen: Dr. Taylor and I got hold of Dr. Purdy last evening and talked to him about the possibility of meeting with the Ceramic Educational Council. Apparently he did not sleep well on our story because he called Dr. Taylor at six-thirty this morning and invited us to join in this meeting.

First, with regard to deferment of students in ceramics, we at the Pennsylvania State College have not had any trouble thus far. Mining and metallurgical engineering were included in the first approved list published months ago. Mining engineering and metallurgical engineering were not listed separately, similarly to the other engineering curricula. The list was based on the names of the professional societies. In other words, metallurgy was considered simply an offspring or a stepchild of mining engineering.

I appealed in Washington months ago to have ceramics, petroleum and natural gas engineering, and fuel technology added to the list and was informed that it could not be done because of established codes, but that mineral technology could be added, so I think you will find that we are listed now as mining, metallurgy, and mineral technology, and ceramics is included under mineral technology. Since then we in Pennsylvania have had no trouble in getting ceramic students deferred.

We are faced now at Penn State and at other institutions with a related problem that is of major consideration at the moment for the colleges. I refer to the Army and Navy advanced specialized training programs, that is, where the Army and Navy after the basic training would send properly qualified students back to colleges and universities for advanced training on a college level. The whole field of mineral industries was left out of that program; mechanical, electrical, civil, and chemical engineering were the only ones included.

Under pressure, metallurgy has been added, but it was made clear that few metallurgists would be needed. The Army Ordnance had requested one hundred. I was advised as late as April 7 that no metallurgist will be sent back to college for the time being. The Navy probably has a similar program in mind.

When the A.I.M.E. held its annual meeting in February, a representative of The Adjutant General's Office was invited to meet with the Division of Mineral Industries Education. The representative, Colonel Gregory, asked for a definition of mining engineering. The Division sent a definition to the board of directors who, in turn, officially transmitted the definition to The Adjutant General's Office. Mining has not been added in spite of the definition, which definition is a "mess."

We feel that after the summer term there will be no mineral industry students left in colleges and universities unless they happen to be cripples or girls. We have a few women students now. In spite of the fact that the industry needs men and we may be able to continue their deferment, a boy is not likely to stay in college alongside a man in uniform, particularly when the man in uniform has $50 put in his pocket every month. The pressure on a red-blooded American boy is too great to do that, so we do not expect very many students. The enrollment in our School of Mineral Industries of 444 a year ago will be practically nil after this coming summer term unless we are finally approved for the advanced Army specialized training program.

This leads to the basic problem which we discussed with Ross Purdy last night and which is probably the reason why he invited us to come to the meeting this morning. Present definitions of ceramics are headaches. I have been at Penn State since 1928 and am supposed to have administrative reponsibility for our Department of Ceramics, and it is impossible to get the public to realize what ceramics is.

In 1920, the Bureau of Mines published a Glossary of the Mining and Mineral Industry which is recognized as a classic. In it is the word "ceramic—of or pertaining to pottery, including porcelain and terra cotta or its manufacture, fictile art, or ceramics in general." Then there is the word "ceramics—that department of plastic art which includes the production of all objects formed by molding, modeling, and baking clay, such as terra cotta and pottery in general, fictile art. The objects so made."

Then there is a definition of "ceramist—a person devoted to the ceramic art, whether as a manufacturer, a designer and decorator, or as a student or connoisseur."

The definitions in the Standard and Webster dictionaries are no better than that.

The A.I.M.E. definition of mining engineering officially transmitted to The Adjutant General's Office is perfectly amazing. It reads this way: "A course in mining engineering gives basic engineering training similar and equal to that of all other engineering courses. It in-

[1] See p. 180, June, 1943, *Bulletin*.

cludes training in the practical application of mechanical and electrical engineering, and, in addition, includes applied geology in its engineering aspects." The mining engineer, therefore, is qualified by training to solve a wide variety of problems important to modern warfare, such as excavating of all types, the selection of terrain, making use of explosives, and the proper handling of noxious gases. Special curriculum titles, such as Petroleum Production Engineering, Geological Engineering, Ceramic Engineering, Coal Mining Engineering, etc., apply to variations or modifications in the mining engineering curriculum, which do not alter its effectiveness as basic engineering training. These titles, therefore, are essentially synomymous with mining engineering.

How can we expect Washington to add ceramic engineering to the advanced specialized training program, or the Navy, when our professional mineral industries society concocts such an ungodly definition?

One of the major problems of this meeting is to bring forth a real honest-to-goodness modern and popularly worded definition of ceramic engineering and ceramic technology. Maybe the word "ceramics" has outlived its usefulness. Why not silicate technology? This expression is more in keeping with the Orton lectures and the program of the present Annual Meeting. The Society certainly is missing an opportunity if it does not produce a definition that everyone can agree to, a unified definition for modern ceramics, ceramic engineering, and ceramic technology. Something should be done now.

DEAN HOLMES: I agree with Dean Steidle that it is a difficult job to educate the public on the subject of ceramic engineering. This is an important problem because the ceramic schools of the country are faced with disaster. The only thing that will save us is to keep engineering students in college. It is definitely for the interest of the defense program to do so. We need engineers.

We should bear in mind that the Army training program is entirely separate and distinct from the deferment of ceramic engineering students and ceramic engineers. There is no connection, no relation. Furthermore, there is no satisfactory definition for ceramics except The American Ceramic Society definition. We do not accept Webster's definition. We do not accept the A.I.M.E. definition, but we do accept The American Ceramic Society definition which is clear, specific, and definite. We know where we are. We know what field we are working in.

The important thing for us to do at present is to get the word "ceramics" listed in Bulletins 10 and 11. Mineral technology, mining technology, and various other fields are listed, but not ceramics, and it is perfectly illogical to leave ceramics out.

The draft boards will not defer ceramic students simply because we say ceramics is a branch of the mineral industries or of chemical engineering. We must get the word "ceramics" included in that list of preferred occupations. We are going to pass up a big opportunity unless we do so.

DR. TAYLOR: As Ross invited me to come in this morning, I will just read you a recommendation which will be discussed by the Ceramic Educational Council meeting at noon and which we hope will be approved by the Council and returned and submitted to this group later.[2]

DR. ANDREWS: Would you like The American Ceramic Society definition read? It is as follows: "The branch of engineering concerned with (1) the mining, refining, and processing of the minerals and rocks, except coal, oil, and ores as such; (2) the manufacture of products therefrom; and (3) the design and constrnction of the necessary equipment and structures."

DEAN STEIDLE: Do I understand that this is the definition of ceramics approved by The American Ceramic Society?

DR. ANDREWS: It is the official definition of ceramic engineering of the Institute of Ceramic Engineers.

DEAN STEIDLE: If that is the definition, my whole conception of ceramics is wrong.

DEAN HOLMES: What is your objection?

DEAN STEIDLE: I do not think it covers ceramics. Ceramics is more technology than that definition would indicate.

DR. SOSMAN: Ceramic engineering is what we are defining, not ceramics.

DEAN STEIDLE: How are you going to differentiate between engineering and technology? If that is the definition you are handing out to the public on ceramics, you are missing about 80% of the field of ceramics.

DEAN HOLMES: That is intended only to cover the field of engineering. We should have another definition.

DR. SOSMAN: When was that definition approved?

DR. GREAVES-WALKER: At the Board of Trustees meeting that set up the Institute of Ceramic Engineers. I think this is a perfectly satisfactory definition of ceramic engineering. It does not intend to define ceramic technology.

DEAN STEIDLE: I do not know much about ceramics, but to me that definition is twenty years behind the times.

PROFESSOR CARRUTHERS: In connection with this, I want to present an idea that I presented to this Committee when working on the resolution at Columbus. It is a different analysis of engineering education from that usually followed.

There are five principal fields or types of engineering that we deal with. First of all, in engineering work we are dealing with energy, materials, transportation, structures, and men. Engineering concerned with these items constitutes the five principal fields. The work with relation to energy is done by the electrical and the mechanical engineers, whose prime efforts are in the generation, transmission, and utilization of energy. If the work in the electrical and mechanical fields is analyzed, we find that practically all of their work deals with energy in one form or another.

We also have the work in materials and utilization of raw materials. There the mining engineer deals with the metallic ores, refines them, prepares the metals, and treats the metals for their utilization. The ceramic field is devoted to the nonmetallic minerals in the mining, refining, beneficiation, and producing of products from such minerals. The chemical engineer is also primarily concerned with materials.

For structures, we have the civil engineers and the architectural engineers, and in transportation we have aviation and the civil railway engineer and the marine engineers.

When we deal with men and manufacturing, we have the industrial engineer.

An analysis of all of our engineering along some such line definitely places the ceramic engineer right in his particular field. It is in the handling of nonmetallic minerals and taking it through all the phases from mining up to its utilization, and of course includes the technology that is involved.

SECRETARY PURDY: Would that make him analogous to a mining engineer?

DR. GREAVES-WALKER: The definition adopted by this Society was written at the request of the E.C.P.D. that they might know what ceramic engineering is in their efforts to accredit the various departments. It was successful because every department of ceramic engineering in the United States today, where degrees are granted, is accredited, and it is the only branch of engineering in which 100% of the departments are accredited.

I am a member of the Selective Service Committee of the American Institute of Mining and Metallurgical Engineers and as such I have handled a great deal of their work in Washington during the past year. We have been in contact with all the top men in the War Manpower Commission, particularly Edward Elliott, President of Purdue University, who handles all of the educational matters for Paul McNutt. Every time I have been in his office and the offices of the others I have probably talked as much about ceramic engineering as mining and metal-

[2] See p. 185, June, 1943, *Bulletin*, for the resolutions read by Dr. Taylor.

lurgical engineering. They know what it is, what it covers, and how important it is, but time and again they have refused to list ceramic engineering. At our suggestion, they did put in mineral technology, mining and metallurgical engineering, and mineral technologists. The other branches have been just as hot after recognition as we have, e.g., the geological engineers, the geologists, the fuel engineers, the fuel technologists, and the petroleum engineers. Everybody knows petroleum is very important in this war, and still the petroleum engineers are not mentioned. They said there were too many branches of the mineral industries to mention them all, that mineral technology would cover all of us, and that could be explained to draft boards, and I can tell you that ceramic engineers have been just as successful in obtaining deferment as mining engineers, metallurgical engineers, petroleum engineers, geological engineers, and others. We have had no more difficulty than other branches of engineering.

I know this from the records they have in their offices, and I do not believe any of these resolutions are going to make a particle of difference. In fact, I am sure they are not because they say we are in there.

When it comes to getting into the Army training program, they did add metallurgical engineering after some pressure was put on them. I think that Dean Steidle is mistaken about the number; they want only fifty metallurgical engineers. They are not going to put that in the Army training program. They are going to take fifty metallurgical engineers out of the Army and give them special training.

The last thing we did was go to Washington and ask them to put in mining engineering, and I might explain the definition which bothered Dean Steidle so much; I had a good deal to do with the writing of that last paragraph. That was an effort to impress the Selective Service Commission and the Army training people with the fact that mining engineers, ceramic engineers, and all of these mineral industry engineers were important to the war effort. We wanted to get all of them in on the training program, and it was necessary to develop a definition, not of mining engineers, but a definition that would accomplish our object. We took that to Colonel Beukema. As a result of our talk with him, he said, "We will put mining engineering into the program if the Army wants it." A week or two after, we received letters from the Army Training Division saying they had called or would call for seventy-five mining engineers; these men were to be trained particularly to dig up unexploded bombs, mines on the battlefield, etc., because they were trained in handling explosives, but they were not to be put in a training program because they could obtain seventy-five mining engineers from the Army.

The A.I.M.M.E. is a fairly powerful organization, which covers practically all the metals and minerals as they do in this war period, and if they cannot get any further than they have with their resolutions and trips to headquarters, I am pretty sure that you are wasting your time in making any effort to get ceramic engineering listed, and especially when they can show you that the ceramic engineers have received just as good treatment as any other branch of engineering.

MR. EAGLE: I received a copy of the resolution and waited for two or three weeks, not wanting to jump the gun on your sending it to Washington and then figuring you had sent it. I took the resolution to our representative on the War Manpower Commission and talked it over informally. He came back to the point I had made earlier as to just what we wanted for ceramic engineers in industry. He said, "Do you mean you want a blanket deferment for all graduate ceramic engineers?"

I said, "No, I do not think that is the purpose. We want equal treatment with mechanical, electrical, and all other engineers."

He said, "You already have that."

I replied, "I do not believe we do, that is, not in any form that a draft board can lay its finger on immediately."

He walked over to his file and pulled out group 22, a list of essential occupations, and read "production of stone, clay, and glass products;" it lists a great many jobs, but it comes down to one subheading; to engineering, professional and technical, and it lists ceramic engineering, chemical engineering, industrial engineering, mechanical engineering, plant engineering, etc., in so many words. He said that is available to every draft board in the country and that we have the same treatment as mechanical, electrical, and all other engineering.

He said there is one point that is forgotten in some of the deferments. An industry deferment does not count. Deferment must be based on the essentiality of a given plant. A ceramic engineer in a steatite porcelain plant could probably win deferment without trouble. A ceramic engineer in an art pottery probably could not win deferment. If you would like, I could turn this over to the Board.

C. E. BALES: I am glad Jake Eagle spoke before I did, because that is what I was going to touch on. I have been a member of Dr. Andrews' Committee for a year or so. At first the most interest was to secure deferment for ceramic engineers in industry. Since then, this secondary matter of ceramic students has developed, and this seems to be the prime purpose of our Committee work.

As Jake brought out, the draft boards or the Selective Service System was worked on in our industry by the president of the American Refractories Institute. He is in Washington quite a bit and he was told, as Jake mentioned, that this definition of engineers, technical and professional, would take care of ceramic engineers.

I have worked on about six different draft boards. We have had no difficulty in securing deferment for ceramic engineers, ceramic technologists, even firebrick molders; in fact, one draft board in Uniontown, Pa., where some of our men have to report, writes us every six months to ask if we still want the firebrick molders deferred. They have been very cooperative. When the thing started out a year or so ago, we had to work on the draft boards, tell them at least what refractories meant to the war program, and what the word "refractories" meant. They have been very cooperative, and I think the thing Jake mentioned, so far as industry goes, is the real word on it.

With the educational program, Dean Steidle mentioned that specialized Army training and the situation regarding the ceramic schools now are critical. There is no doubt about it, but, as Dr. Greaves-Walker has mentioned, they are not going to do very much for that other than what they have done in mineral technology. The reason for this is, as I understand it, that the people they are putting in these specialized training courses are engineers they want to train for a certain specific job in the Army and Navy. They claim they have no use for ceramic engineers.

One point that our Committee tried to bring out was that the basic training of nearly all engineering courses was essentially the same, mathematics, mechanics, etc., and that even boys who are trained in ceramic engineering could be used in a great many other engineering jobs that the Army and Navy want, but it will be difficult to convince the officials that they should list the name "ceramic engineering" just to accomplish that phase of it.

Industry is taken care of. If you are in an essential engineering business and have ceramic engineers, there is no difficulty in getting those men deferred, but the educational side is something else.

DR. GREAVES-WALKER: May I add just one thing more. In this army training program, you may not all understand that the Army Training Division had nothing to do with the selection of the type of training to be given in the Army and the type of men they wanted trained. Each branch of the Army was requested to turn in a list of the branches of engineering in which it wished men trained. The top men in the Army in Washington today are West Pointers. In the first place, they know only military engineering and civil engineering; as a result, the great majority of the 150,000 men to be trained are to be civil engineers because that is the West Pointer's idea of an

engineer. He is an all-round man. They presume he knows how to do everything. In fact the Army engineers trained at West Point do practically everything, hydraulic engineering, etc., and they think they understand any job whether they know anything about it or not. There was no branch of the Army that said they could use mining engineers, metallurgical engineers, ceramic engineers, or petroleum engineers, etc. Consequently, the training division says, "We cannot do a thing about it. We do not have a thing to do with it. The infantry, the engineers, and so on, tell us what they want, and that is all we can do about it."

In getting these seventy-five mining engineers into the group, we had to go to the top man in the Ordnance Division. After explaining to him what mining engineers could do, he said, "Sure, I know. We can at least use a few of those boys to handle mine fields and duds that drop around the camps." That is a beautiful job. I do not expect any of the mining engineers would be particularly pleased to get in that branch of the service.

DR. ANDREWS: After our meeting in Columbus, I wrote a rather voluminous report for the committee on deferment. (Dr. Andrews read from the Annual Report by the Chairman of the Special Committee on the Status of Ceramic Engineers with the Selective Service Boards.)[3]

As far as the present student body is concerned, I believe it is too late to do anything. The situation is such that the students we now have are practically all signed up and ready to go and most of them will be in active service by June. There will be a few 4-F men left. Possibly I am not right about all schools but I think this is true for most of them. It is true at Illinois, and I think it is true at Ohio State. There is really nothing that we can do to save for the industry the ceramic engineers who are now in school, and there probably will not be many more being graduated for the duration. The colleges as well as the high schools are being raided for men. A man can enlist in the Navy at seventeen years of age, and men in the high schools are actually enlisting, especially when they are subject to the criticism which I mentioned in the report. The men cannot stand it. You would not want to either. The boys in school may have a day off during the weekend. They used to go home, but now they do not go home because they are criticized for not being in uniform. Somebody says, "Why are you not in the Army?"

Dean Enger told me that a man from southern Illinois came to him and said, "What is this I understand about the engineers you are training being deferred? These are single men, they have no responsibility, and while they are being trained in engineering you can get them deferred indefinitely. With us they are taking married men and men in the industry and putting them into the Army." This is the attitude these boys are up against. When the Army trainees get into the colleges it will be worse because when they get there most of the men will be in uniform and the man who is not in uniform will be conspicuous. I do not think there will be many that can stand it, regardless of what we do.

In regard to specialized service for ceramic engineers, I do not see where we have a very good argument. I have read a lot of Colonel Beukema's writings with regard to this program, and I remember one statement clearly. He said, "This program is not to save the colleges. This program is to train men for the Army." With that viewpoint in mind, I do not believe we can do very much with the training program.

PRESIDENT TROSTEL: Dr. Andrews, do you still think that the resolution should be presented? Do you think the ground has been pulled out from under it?

DR. ANDREWS: As I told you when we first brought this up, it had to be done right away or there was no use in making an attempt. I think Dr. Greaves-Walker will agree with me when I make this statement. I do not think any of the metallurgists or mining engineers will actually obtain an Army specialized service training.

[3] See pp. 180–85, inclusive, June, 1943, *Bulletin*, for complete report

DR. GREAVES-WALKER: There is no intention of including ceramists in the training program.

PROFESSOR ANDREWS: No program is set up for them. The programs of the civil, electrical, mechanical, and chemical engineers are definitely set up and the schools have them. They know what they are going to be. Nothing has been done for the other miscellaneous groups and probably nothing will be done. The Navy program is more sensible than the Army program all the way through; that does not provide for the ceramic engineer either, however, but the Navy is giving a much more liberal training than the Army.

PRESIDENT TROSTEL: The way the matter stands, do you think the ceramic engineer in industry is taken care of and that there is no hope for the student?

DR. ANDREWS: I cannot see any hope for the student. Let me mention one more thing about which I have been hesitant and about which you should all be thinking. After the war is over, there will be a critical shortage of all technical men. The ceramic engineer who is not going into service at the present time is frequently going into other branches of the industry, into heat-treating and other work, and he will become established there and will not come back. When the war is over the schools will not have any backlog. Usually if we have a shortage of men we can depend on the schools each year to turn out a group to supply the need. With what is happening now we will have to start all over again. The way it looks now, it will be four years before any will be available. If we have a moratorium on the training of ceramic engineers for a couple of years, that means two years more. It will take a year or two to start the schools again and four years to graduate engineers. It will be about ten years before we get very many ceramic engineers back into the industry. This is the serious part of the whole situation, and you cannot figure it any other way.

Some men will come back from the service and take up where they left off, but I think myself that, as this war comes to an end, the Army will need all the technical men it can obtain to rebuild what has been torn down; if these technical men are kept in the Army, the industry will have to search long to obtain technical men of any kind.

DR. TAYLOR: Dr. Andrews brought up a point I have had in mind for some time, that is, the importance of looking toward the postwar situation. Chemical engineering right now is getting the best advertising it ever had. Ceramics is getting none. The future blood of The American Ceramic Society are the young men who are trained in ceramics, and the best young men, the most alert, will go into the better-advertised fields. In the postwar competition that is coming, ceramics will suffer seriously because of the present lack of advertising. This is a major problem before The American Ceramic Society today.

J. D. SULLIVAN: I move that the report of the Committee be accepted.

DEAN HOLMES: I second the motion. (The motion was carried.)

PRESIDENT TROSTEL: Dr. Andrews, do I understand that there is no point to further consideration of this resolution? I contacted without success a number of men to go to Washington with the resolution.

DR. ANDREWS: That ceramics is very important to the war effort, I do not think there is any dispute. It would be a good thing to inform the people in Washington about that at every opportunity because, as Jack mentioned, it is one of the main branches of engineering; if we do not fill out all of the branches of engineering in this country, we will have an unbalanced program, and our industry will suffer. I would like to see the resolution taken to Washington. I do not know to just how much inconvenience you should go to do it. We ought to use every opportunity to publicize ceramics. We are suffering from the fact that we did not start such publicity a great many years ago.

Professor Parmelee told me about his coming to the

University of Illinois at the time of World War I. He checked back through his correspondence and gave me a letter from Dr. Washburn to Professor Watts. I think Professor Parmelee received a carbon copy. Their problems at that time were similar to ours, except that the schools were saved by the S.A.T.C., bad as it was.

PRESIDENT TROSTEL: I will not discharge the Committee. I will leave that current and our next President can decide according to his judgment and by discussion with the members of the Committee whether they think they still have a job ahead of them.

MR. EAGLE: Mr. President, for your information regarding the National Selective Service, they are getting some education regarding ceramic engineers. I have proposed deferment for four men, two in California and one in Illinois, I believe (I have forgotten where the other was). They had been deferred temporarily and then reclassified into 1-A and had appealed and gone to their State Selective Service Director and had been turned down. The case was then referred to Washington and the routine seems to be that if that happens they apply to our Section in the War Production Board. As the Nonmetallics Section, we write a letter to the National Bureau of Selective Service, outlining the case, giving our reason why (if our judgment on the thing warrants it) a man should be deferred and certifying to the essentiality of his occupation, and we have had good cooperation.

In two cases, Colonel Beukema has written to the State Director of Selective Service recommending that the case be reopened. They do not issue from Washington a directive to any State Director. The thing is set up more or less on a home-front basis and they do not presume to tell a State Director he must reopen, but representation from the National Bureau is quite strong.

DEAN STEIDLE: Mr. Chairman, may I plead once more? I am fearful I was misunderstood in that I was thinking of a resolution to go to Washington. That was far from my thought. I quite agree the door is closed in Washington. The door is closed, however, because you do not have a logical, unified definition for the field of ceramics. My only recommendation is that The Society review the question of definitions and plan now for the postwar period.

Ordnance is coming to us frequently for men trained in glass (we do not have them to offer) and men who know insulating materials like steatite. They are not coming to us for men who fit the definition read by Dr. Andrews.

I fear that educators in ceramics are divided. The old-timers cannot be taught new tricks and the new men cannot accept old ideas. There should be one broad definition, irrespective of names, rather than several definitions. It is quite clear that we need to educate the public, but the public does not give a rap for subdivisions, or what we title the definition. My feeling at the moment is to call the definition "ceramics" and let it go at that.

Perhaps there should be two definitions, one for technical men and one for the public, but this may tend to confuse the issue. For educational work we need a popularly worded definition of ceramics which represents the spirit and character of the Orton lectures, to my mind one of the best movements in The American Ceramic Society. The stress in our curricula and in our publicity should be on ceramics, and we must normally mention some of the leading ceramic products. The bright boys in the high schools of the country are going into competitive fields of work. We can attract them into the ceramic profession only if we advertise the best and most progressive features of ceramic activities. My first reaction to a definition is presented herewith for your consideration:

"Ceramic engineering and technology are concerned primarily with the industrial utilization of nonmetallic minerals by firing such materials to high temperatures. Typical ceramic products are fireproof heat insulation, structural clay products, refractory firebrick, pottery products and spark plugs, abrasives, cement products, electrical porcelain and steatite, sanitary porcelain, chemical stoneware, welding rod coatings, porcelain enamel, and glass products of all kinds. Ceramics is referred to as comprising the arts and sciences of the silicate industries, and a ceramic engineer and technologist may be a furnace engineer, an igneous physical chemist, or a chemical-mineral technologist. In addition to such basic engineering subjects as mathematics and mechanics, the sciences of chemistry, physics, and mineralogy form the fundamental basis of education of the ceramic engineer and technologist. Ceramic products and processes are integrated with the metallurgical, fuel, chemical, and other industries in countless ways."

SECRETARY PURDY: We must think of postwar, as well as war. The war situation is closed, perhaps, but the postwar situation is not. This Committee is to be continued. The new President will instruct that Committee on postwar activities.

We have in the Institute of Ceramic Engineers a change in constitution or rules for admission of members, which is far more stringent than it has been and which requires that they be professional engineers to qualify as such (see this issue, p. 251). They will have to meet the specification that has already been read for engineers. The new definition for membership for ceramic engineers would preclude ceramic technologists who have not had engineering training.

DR. ANDREWS: I would like to present one more idea. If the industry is to have technical men after the war, the initiative should come from the industry. We at Illinois saw this thing growing on us and we made an attempt to obtain students. We sent out letters to 900 high schools, stating the advantages of ceramic engineering and its advantages after the war, and we placed a notice on the bulletin boards suggesting that men not entering the service should go to school and take ceramic engineering. We suggested that girls might be interested in taking some of the courses and that we will need men badly after the war and that any young man who wants to train now for the war and postwar periods would be smart to get into ceramic engineering.

The industry can direct a lot of men to ceramic training if they form a program and lay plans. If they do not do it, they will not have men.

REPORT OF COMMITTEE ON RESEARCH

During the past year a large amount of ceramic research has been on war problems, the nature of which cannot be disclosed for reasons of security. Many problems have been dropped temporarily and replaced by problems of more vital nature to winning the war. In some instances basic research has been definitely limited by a lack of personnel and in general all the research institutions and laboratories have suffered in some degree from this situation.

It is encouraging to note, however, that, in addition to war research on critical and substitute materials and development of new ceramic products produced for the duration by certain manufacturers whose normal products are not essential to the war effort, a considerable amount of fundamental ceramic research has been carried on and plans are now being laid by some branches of the ceramic industry for postwar operations.

Art

To summarize current trends and recent developments in design and color it can be said that present conditions

are reflected not only in the many production problems that have arisen but also in design (1).* Eliminations, restrictions of materials, difficulties in transportation, shortages of labor, limitations in fuel consumption, the ever-increasing demands on production, etc., have all made themselves felt in one way or another.

The manufacturers of pottery and glass have met this situation in some instances by reducing the number and amount of colors used, limiting the number of shapes and patterns, and adapting existing designs. At the same time, others have announced that no new patterns will be introduced until after the war.

Present conditions also have increased the trend toward products which are much more native in character. This is seen in the use of military insignia, folk-lore, historical and Disney characters, and American flora and fauna in both form and decoration.

Although production for the war effort is still paramount, many new products for civilian use are being designed and produced to replace those using restricted materials, e.g., such functional items as cooking ware, coffee makers, stoves, sinks, linings for refrigerators, grates, container closures, and mailboxes.

With no relaxing of present conditions contemplated in the near future, function probably will continue to be the keynote in the design of ceramic products. A continuation of the excellent work already done in developing ceramic substitutes for vital materials and products is essential, however, if the industry is to be prepared for the postwar era with its demand for replacements in both industrial and household equipment. To cope with competitive materials as well as imports, research should be expanded not only to improve existing materials, equipment, and methods of manufacture but to include the design and creation of new products.

Considerable work has been carried out on low-temperature artware bodies and glazes which employ nepheline syenite (2, 23, and others). This type of body is finding increasing industrial use.

A body combining nepheline syenite, talc, and clay was developed to vitrify completely at cone 2 and self-glaze at cone 3 (2). This body was translucent, strong, and hard enough to scratch glass and vitrified porcelain. (The ceramic badges used at the 1943 Annual Meeting were made from this type of body.)

A recent line of experiment has been a material which combines some of the useful properties of clay and plaster (2). When mixed with water this material is plastic for a short time and suitable for modeling. It then rapidly sets to a state of hardness in which it is a remarkably fine material for carving. It dries with no shrinkage and may be fired to low temperatures (cone 06–04) without shrinkage. Not enough work has been done on this to warrant any claims for it beyond that it is promising and may find use in pattern making, mold making, and quite possibly in making molds for casting metals without destruction of the mold by the first pouring.

A method has been reported for producing luster glazes in a variety of colors (12). Minute amounts of metallic colorants are introduced in the glaze batch and reduced on cooling. The controlling factors include composition, concentration, and atmosphere.

Work has been carried out on the chronology of the ancient city of Troy through petrographic examination of potsherds and correlation with clay pits of the eastern Mediterranean region. Samples from the original clay pits are fired and compared with fragments of the early pottery (1).

The 1943 Art Division program included discussions of design work underway at the various schools and industrial progress; style trends in dinnerware; designing for the future; highly magnified sections of various materials possessing design suggestion; use of earth colors; and specifications for a small globar kiln for artware research.

* Numbers in parentheses refer to references given at end of this report (see p. 244).

Enamel

The mechanics of adherence of vitreous enamels to metals has been further studied to determine the single and mutual influence of cobalt and nickel oxides on metal precipitation at the ground coat-iron interface by measuring the electrical resistance of the ground coat as it was heated and cooled between two iron surfaces (8).

The principal theories of adherence have been reviewed and a new theory involving hydrogen gas has been advanced. Hydrogen has been shown to be a factor in the adherence of sheet-steel enamels. Adherence, reboiling, and fish-scaling are claimed to be closely related.

Numerous problems involved in the dry-process enameling of cast iron have received continued study (25). Cast iron, the foundation material, has been studied from every viewpoint. Test methods have been worked out to aid in the development of adherence to a high degree with a concomitant decrease in the probability of enamel failure.

Further studies have been made to develop new opacifiers for enamels (12, 26). The opacifying effects of different zirconium compounds when used as mill additions to enamel frits were investigated (12). In some cases, zirconium compounds which were good opacifiers in one enamel proved to be poor opacifiers in other enamels.

Work has continued on the adaption of the two coat-one fire process to the enameling of hollow ware (25).

Test methods have been developed for kitchenware, including impact and thermal-shock tests (6). This investigation included a study of the effects of design, metal thickness, and enamel thickness on the impact and thermal-shock resistance of kitchen-ware enamels. A study has been made of the chemical durability of porcelain enamel surfaces. The factors which influence test results and a comparison of errors encountered in various methods of determining solubility of porcelain enamels were studied.

Chipping of porcelain enamel on the flanges of table tops due to impact has been compared with the results obtained by using the P.E.I. Tentative Standard Impact Test. A correlation was found. It was also noted that the impact resistance of enamels applied over a radius increases as the thickness of enamel increases.

Other researches on enamels include studies of the solubility of iron oxide in ground-coat enamels for sheet iron (6) and the improvement of porcelain enamel in regard to its application on steel (26).

Glass

Various basic glass researches have been carried on. These involve the relationship of structure and vitreous properties, the effects of thermal history, properties versus composition, homogeneity, etc. The difficulty of defining the vitreous state in a rigorous manner, the existence of borderline cases, and the theoretical requirements which must be met if a substance is to be vitreous are points of continued discussion.

The factors affecting the degree of homogeneity of glass have received further attention. Methods of glass preparation vary considerably, and the homogeneity achieved is a reflection of the complete past history of the preparation of the glass.

Study of the mechanical strains present in a sample of glass does not enable prediction of the future behavior of this glass. There is no simple relation between such strains and the physicochemical state of the glass. It seems probable that most of these states may be obtained with or without birefringence, depending on the thermal treatment to which the glass was submitted. If the glass is not in the equilibrium condition for the temperature at which it is being used, it will transform spontaneously toward that equilibrium. The birth and evolution of strains depend on these physicochemical unbalances as well as on other characteristics of the glass. Only the study of the physicochemical state can give reliable indications of the behavior of glass in practical use.

In annealing glass, it is often necessary to change the annealing schedule. Such changes affect the density and

refractivity, and the new schedules may or may not result in an adequate reduction of the strain. A method for computing the effects of any change in annealing schedule has been developed (27). Although the results of the computations are only approximate, they serve as a guide whenever a change in schedule is undertaken. What is more important, they give an insight into the manner in which changes in density and refractivity develop and strains relax.

From measurements made on the delayed or extraordinary volume contractions and expansions in annealing and in "disannealing" glasses, respectively, and also on accompanying extraordinary heat evolution and absorption, it seems that the quantities of heat evolved and absorbed have the same order of magnitude as the heat equivalents of the work done by and against the enormous "intrinsic pressure" (cohesive forces) as glasses contract or expand extraordinarily. In view of these results and other measurements and because of the belief that the structures of glass and many other extremely viscous materials resemble extended and very irregular networks, or cellular-like and random arrangements of very large molecules or molecular chains and structures, an attempt was made to correlate the extraordinary thermal effects observed in viscous materials with the gradual relaxation of molecular strains that presumably are developed with every temperature change in highly viscous liquids (27).

Evidence for the existence of a "transformation region" rather than a "transformation point" in the 10^{14}-poise range of glasses has been produced by a variety of static and dynamic experiments. Refractive index was measured on small specimens quenched in air and directly in the furnace by the single-prism and three-prism methods. Quantitative agreement was obtained, and the method of quenched samples is recommended as the simplest of those tested. Thermal expansion coefficients were also determined on the quenched samples.

Disannealing lowered the refractive index of glasses; for a borosilicate crown, by an order of 0.006. The change resulting from strains was comparatively small and in the opposite direction so the birefringence was found to be an untrustworthy indicator of the state of a glass. For a series of optical glasses, the difference between the refractive-index extremes is a function of the lowest temperature at which the minimum index can be realized. Thermal expansion coefficients may also vary with heat-treatment. Two limiting states of glass are postulated to explain the observations. In between these states lies the region of transformation, including an intermediate state for each temperature between the two limiting temperatures. For all of the glasses examined, the extent of the transformation region was about 100°C. The rate of transformation into the low-temperature state may be studied from "equilibrium curves" by plotting stable refractive index as a function of temperature. Whereas the conversion to the high-temperature state is instantaneous at the upper temperature of the transformation region, the conversion to the low-temperature condition demands a minimum time at each temperature, which explains why annealing is such a time-consuming process. The annealing time, however, may be drastically reduced by following the equilibrium curves in a stepwise fashion. With insufficient annealing, higher temperature states are frozen in and transformation continues even at room temperature, as proved by measurements extending over sixteen months of study.

The structure of various glasses has been examined using manganese as a fluorescence indicator (10). From this work it could be concluded that in many zinc-containing glasses the zinc ion takes the place of silicon, which explains why these glasses are particularly resistant to chemical attack.

Changes in properties of glass resulting from changes of composition have been studied. Equations were developed for the calculation of changes in density, refractive index, and other optical constants produced by the addition of a known relative weight of a given component to a base glass having known composition or properties or by the substitution of one component for another.

Certain constants, characteristic of the component oxides in silicate glasses, which may be used to compute the density and optical properties of glasses, have been reported in past years. The dependence of these constants on the atomic number of the elements (other than oxygen) in the component now has been shown.

The devitrification characteristics of the field of compositions which include the commercial lime crystal glasses were investigated. Tridymite was found to crystallize from glasses containing as low as 62% of SiO_2. Tridymite, devitrite, diopside, sodium disilicate, and an unidentified compound were found to be primary phases. Potassium oxide (K_2O), in general, lowers the liquidus temperature when it replaces Na_2O.

The effect of variation of composition of optical fluorcrown glasses on the optical properties has received attention. The compositions were restricted as far as possible to low molecular weight oxides, such as silica, fluorine, boric acid, alumina, and alkalis. The index of refraction was found to be lowered by substitutions of fluorine and alumina for silica; the reciprocal dispersion, however, is increased by fluorine and lowered by alumina so that fluorine and alumina can be balanced against each other to give a range of desired optical properties.

A new type of black glass has been developed (10). It belongs to the group of "striking" glasses where phosphides of iron or other heavy metals are formed on cooling or reheating. Large-scale experimental melts have been carried out in a glass plant. Black glass is cheap and requires no colorants whose use is restricted by priorities.

A new method of producing multicellular glass from crushed soda-lime glass containing small amounts of sulfates and powdered ferrophosphorus has been studied (10).

The apatite opal glasses or Moonstone Glass, the theory of which has been previously discussed, are now produced on a large scale (10).

A new method of glass fabrication, the Multiform process, has been developed, which is applicable to a number of glass compositions of widely different characteristics. At present the method is used for the production of insulation for electronic equipment.

A basic research on plate-glass technology has effected substantial advances in methods for evaluating the flatness and texture of surfaces (25). Plate glass of sufficient flatness for use as surface plates for fine gauging work affords a superior replacement for the older metal plates. The use of monochromatic light in developing interference patterns or Newton's rings permits a rapid examination of surface finish and flatness. Glass approaching optical flatness may be produced for test plates and other purposes requiring high accuracy of surface. The topographic profilograph, which graphically measures surface textures, has proved to be valuable in studying details of the processes of grinding and polishing glass. Accurate measurements of thickness and parallelism of surfaces have provided for improvement of optical properties.

A research was conducted to obtain some evidence of the nature of the fire polish on sheet glass. The results were based on three measurements. The first of these was a careful measurement of the deviations from Fresnel's reflection laws using a photographic polarimeter. A second method consisted of determining the apparent Brewsterian angle as compared to that calculated from the index of refraction of the glass. The true index of refraction was measured by a prism method. These measurements showed that freshly drawn sheet glass probably has a crystalline layer several molecules thick on the surface. This layer is of high index but is counteracted quickly by water absorption if the glass is dampened slightly or exposed to the atmosphere.

The chemical attack of glasses by water is considered to be a diffusion phenomenon in which the rate of release of soluble matter from the glass is slow compared to its rate of diffusion in the attacking medium. An equation based on the assumed conditions has been set up to fit laboratory

test data and also to offer some basis for extrapolation of results from accelerated tests to service conditions.

The actual change caused by storing neutral grain spirits, gins, and various whiskies in glass bottles supplied by nine different manufacturers and in Pyrex-brand glass at room temperature for three years was determined. The effects of commercial glass on the pH of neutral-grain spirits are greater than on gins, blended whiskies, and whisky, respectively. The pH of these products continues to increase proportionately with the time they are stored in commercial glass bottles. Alcohol and gin stored in Pyrex-brand glass remained constant for one year and increased slightly in pH during the time studied. The pH of blended whiskies and whisky stored in Pyrex-brand glass remained constant.

Two viscometers which yield highly reproducible results have been constructed for the measurement of the viscosity of glass throughout the entire temperature range encountered in practice. It is shown that the data in all cases fit a Fulcher-type equation, $\log \eta = -A + \frac{B}{T - T_0}$.

The ring-section technique has been studied by the Standard Testing Procedure Committee of the Glass Container Association, and a tentative Standard Method of Examining and Grading Glass Container Ring Sections has been proposed.

A laboratory study was conducted on vertical temperature gradients obtained in a small furnace heated over the glass surface. A surface glass temperature of 2615°F. was held, and the effects of various coloring agents, such as ferrous iron, ferric iron, manganese, and cobalt and chromium oxides, were obtained. These effects were compared with certain commercially colored glasses. The data are important when comparing the maximum melting capacities of commercial furnaces inasmuch as they indicate the over-all heat transmission to the various colored glasses at various depths.

A method has been developed for estimating the expansibility of glass at high temperatures (12). Molten glass fills to overflowing a measured cavity in a refractory block; on cooling, it leaves a depression whose volume can be measured. After correction for the volume change of the refractory, the cubical expansion of the glass is estimated.

The aging of glass thermometers has been studied (10). The depression of the ice point is a phenomenon observed when a previously heated thermometer is tested at 0°C. The reading rises to normal in a day or so. A similar phenomenon but sometimes extending over several months is called aging. All new thermometers have to be artificially aged before being sold to the public. Investigation shows that the aging is an elastic aftereffect, due primarily to physicochemical changes in the glass of the bulb. The change in readings follows an exponential law, rapid at first, then gradually stopping. Methods of evaluating the characteristic rate and the ultimate change were developed.

Other researches on glass include development of selenium ruby glasses and use of selenium in glass (26); structure of sodium-borate glasses as affected by temperature (6); the fluorescence of glasses at temperatures from that of liquid air to the softening temperature of the glass (6); the influence of iron oxide on the melting rate of glass; the solarization of glasses as affected by their iron oxide content; the fading of glasses containing cerium; the durability of glass surfaces as affected by polishing; the determination of density by a flotation method; and studies on devitrification, electrical conductivity, and thermal expansion of glasses (6).

Materials and Equipment

The Nonmetallics Division of the Bureau of Mines is working almost entirely with the strategic minerals needed to win the war. Many resources of nonmetallics are of utmost importance to vital war activities for purposes other than the extraction of metals, and other projects, previously being studied, have been suspended for the duration to devote all possible effort to increase the availability of these urgently needed materials. This program includes supplementing and replacing nonmetallic minerals which were formerly imported (a report of this work is summarized in Bureau of Mines Report of Investigations No. 3675).

Filming and other mineral-dressing processes have been applied to many nonmetallic materials of general interest to the mineral industry and of specific interest for national self-sufficiency (29 and others). Concentration of various minerals by flotation, agglomeration, adhesion, classification, tabling, screening, conductance, contact potential, and dielectric electrostatic separation, high- and low-intensity magnetic separation, attrition scrubbing, attrition and self-grinding and by combinations of these methods has been effected. The minerals concentrated included alunite, andalusite, barite, bauxite, calcite, cancrinite, silicon carbide, chromite, clay, corundum, feldspar, fluorite, graphite, garnet, gypsum, ilmenite, kyanite, muscovite, nephelite, phosphate rock, pyrite, rutile, sericite, serpentine, silica sand, sillimanite, talc, topaz, and zircon.

As the necessary condition for flotation is the attachment of air bubbles to the mineral to be floated, a study of the effect of flotation reagents (collection, activation, and depression) upon the air-water-mineral contact angle is of great value in determining the usefulness of the reagents (10). Contact angle supplies information about the reagents which cannot be accurately obtained from actual flotation tests, owing to the great number of variables present in such tests. Studies have been made on certain reagents for quartz and for clay (10).

Problems involving the rapid identification of small amounts of special elements present in ceramic raw materials and products have been solved by the use of organic microchemical tests (10).

Thermal-reaction effects of individual minerals in a sample are registered photographically on a moving chart by means of a differential-thermocouple arrangement and accessory electrical equipment (31). The kind and percentage of each constituent are determined from the positions of the irregularities and measurements of their magnitude.

An outline for qualitative testing of clays has been prepared (29). The syllabus is based upon a careful survey and evaluation of various tests in use and upon the indicated uses of the clays, both ceramic and nonceramic, rather than on the mineral or geological type of the clay. The whole series of tests is so designed that they may be carried out by a relatively inexperienced operator using rather simple equipment and yet obtain reasonably accurate results. One test developed for this outline involved a rather extensive study of the various types of clay minerals insofar as their dehydration and rehydration characteristics are concerned. Previous studies on dehydration have shown some overlapping, but with the results obtained by rehydration, separations of certain minerals, notably halloysite, are readily possible.

Of all the physical tests made to indicate manufacturing behavior after the product classification has been made by fired color, the two most important are bonding strength and shrinkage. Into this problem enters others, including methods of preparation, adjustment of tempering water, accurate methods of measuring shrinkage, determination of pore space, and correlation of these factors. Classification of the clays in the fired state differs from that in the plastic and dry states because of the loss of organic and volatile plasticizers and the importance of nonplastic fluxing impurities, which act as bonding agents at high temperatures. Correlative tests of standard samples at different laboratories are needed.

Classification charts have been made of thirty-six different clays for both the dry and fired conditions, using strength versus pore space (29). Pore space, which varies inversely to shrinkage, has given better correlation values than shrinkage measurements. The individuality of clays in the dry state and the great difference in strength between the weak kaolins, the strong ball clays, and the powerful montmorillonites and bentonites are shown.

A symposium was held at the 1943 Annual Meeting of The American Ceramic Society on testing and classification of ball clays. This was a continuation of a similar symposium held at the previous meeting.* Basic classification methods, selection and preparation of representative clay samples, standard compositions, specimen preparation, determination of unfired and fired properties, and firing procedure were discussed.

Studies on the hydration of clays have been made (10). Hydration characteristics of kaolin and of bentonite, saturated to the base-exchange capacity with H, Ca, Na, and K, were investigated by (*a*) measuring the heat of wetting in a calorimeter, (*b*) determining the sorption of water from controlled humidities, and (*c*) studying the thermal dehydration behavior with a differential thermocouple.

K-clays showed the lowest heat of wetting and the lowest water sorption; the sorbed water was removed at the lowest temperature. Na-clays, compared to K-clays, had a somewhat higher heat of wetting, a greater water sorption, and required a higher temperature for the removal of the sorbed water. H-clays had still higher heat of wetting, water sorption, and temperature of dehydration. The position of Ca-clays with respect to H-clays was not the same in all tests. The Ca-clays evolved a greater amount of heat when wetted; they showed a greater sorption of water at low humidity, but a somewhat smaller sorption at higher humidities, and required the highest temperature for removal of the sorbed water. The general order of increasing hydration appeared to be K, Na, H, Ca.

The saturation of bentonite by one cation in place of another caused a greater percentage difference in the heat of wetting and in water sorption than did a similar replacement in kaolin. Evidence indicated that the hydration of the clays depended not only on the character of the absorbed cations, but also on the nature of the clay mineral surface which was not covered by these ions (10).

Clays for complete substitution for imported clays have been under investigation for the past several years. As long as the shipping lanes to England are open, a shortage of English china and ball clay will not likely develop; suitable all-American ceramic bodies have been worked out, however, to replace those using imported clays.

The development of a synthetic clay to be used for casting was carried on (23). A clay was developed by blending certain domestic kaolins of controlled particle size in such a manner as to produce a clay which gave as good or better results than the English clays. Casting slip control has received continued study (6, 8, and others).

Methods for estimating the casting behavior of clays have received consideration. These include the determination of casting rate, permeability, water retention, viscosity, thixotropy, shrinkage, and dry strength. By determining the effect of varying increments of electrolyte on the foregoing properties, it is possible to select clays which have desirable casting characteristics for commercial use. Samples of fast- and slow-casting kaolins and ball clays were used to indicate the utility of the methods employed, and results are also given for a composite body. In developing those test procedures using the Buechner funnel (vacuum), the effect of the following factors was determined: mixing procedure, ratio of clay to flint, feldspar vs. flint as the nonplastic, electrolyte content, quantity of slip used, specific gravity of slip, slip temperature, aging, pressure, and equipment variations. After consideration of these factors, the optimum procedure for testing clays was evolved.

The use of the Brabender plastograph for measuring workability and plasticity of ball clay has been investigated further (12). The plastograph was modified to give curves free from the large oscillations which are frequently encountered when this instrument is not properly adjusted. It was found that this apparatus could be used to measure the plasticity of clays, the power consumption required to pug clays, and the consistency of jiggering bodies.

A symposium was held at the 1943 Annual Meeting of The American Ceramic Society on the occurrence, properties, and uses of domestic talc suitable for high-frequency insulation. Before the war, talc suitable for such purpose was largely imported. With the increased production it became necessary to locate new sources.

The physical testing of talc was discussed (32). It was pointed out that high-lime talcs usually have a shorter vitrification range and a high shrinkage, although the latter is not necessarily true. The shrinkage also depends upon the fineness of grinding and the green-pressed density. In testing talcs for production the chemical analysis is helpful for preliminary classification, but the important criterion is the successful substitution of the talc in a production body.

The physical chemistry of firing steatite bodies has been reviewed (7). From the silicate chemistry viewpoint, it appears to be impractical to lengthen the firing range without deleterious effects. The short firing range is due to (*a*) a comparatively large percentage of the body composition becoming liquid at the eutectic temperature and (*b*) the rapid rate of increase in liquid content with temperature rise.

A study has been made of talcs alone and in a steatite body in which the Al_2O_3 was derived from a clinochlore vs. kaolin and ball clay (8). The effects of additions of SiO_2 and MgO to a steatite body and the use of eyrite as a plasticizer was also determined.

Examination and sampling of all domestic sources thought to have talc of suitable grade has been carried out (29, 32).† Beneficiation tests by froth flotation were conducted on a large number of talcs. Properties of bodies made from various talcs have received study (12 and others).

Electric firing of talc bodies has shown that the quality of the electrically fired ware is equal to the usual oil-fired product and better for certain special bodies and glazes because of cleaner oxidizing conditions (32).

An investigation was made to determine whether the iron and other minor impurities were present as constituents of spodumene itself or whether they occurred as a separate phase (27 and others). The cleanest, clearest material from various spodumene deposits was selected and the minor constituents determined quantitatively by the spectrographic method. The data showed that the impurities lie within the spodumene itself and consequently cannot be removed by mechanical processes. Neither petrographic nor X-ray studies showed any significant differences in the spodumenes. The X-ray diffraction pattern gave no evidence of a general displacement. The combined data suggest that the impurities exist as isomorphous replacements in the spodumene structure. Potentially commercial deposits of spodumene should be examined closely for objectionable minor constituents, for they may occur in the spodumene itself and therefore may not be separable by mechanical processes; the X-ray powder-diffraction pattern for spodumene is given.

Researches have been conducted on North Carolina shales (7). The effect of soda-ash additions, deairing, etc., on the physical properties has been determined. Soda-ash additions had little effect on the properties of Triassic shale, whereas the properties of a Pre-Cambrian shale tested were improved by such additions. The use of hot water in pugging was only slightly beneficial. A method of determining the dehydration curve of a shale was developed. Continued research on shale is under way.

Studies on the use of waste grinding sand from plate-glass manufacture have been continued (25). Further investigations of particle-size fractionation and chemical surface treatment are being conducted to obtain products having specific properties for new applications.

Systematic studies of the chemical and physical properties of pozzuolanas, which are siliceous minerals, such as

* See *Bull. Amer. Ceram. Soc.* **21** [11] 248–91 (1942).

† For symposium papers on this subject see pp. 223–30, this issue.

volcanic ash, diatomite, burnt clay, or shale, etc., have been continued (27). The plasticizing action of pozzuolanic minerals is generally recognized. Coefficient of plasticity, measured upon the basis of stress-strain relationship, was a good measure of over-all workability and correlated well with the directly measured water retention.

The production of alumina from clay and low-grade bauxites is being investigated (32). The low-grade, high-iron, and high-silica bauxites of Georgia and neighboring states and the deposits in Arkansas probably offer the best possibilities.

The problem in beneficiating bauxite is one of recovering gibbsite, the principal aluminum-ore mineral in bauxite, and rejecting clay and other accessory gangue minerals (29). Some bauxites concentrate readily whereas others require fine grinding before separation can be effected. Flotation has certain limitations, but the process is applicable to many bauxites.

The selection and utilization of silica sands in the State of Washington has been undertaken (30). The P.C.E. values, which indicate the approximate silica content and give a clue to the kind of metal that may be cast in a mold from a given sand, were determined. None of the sands tested in sandblast tests were as good as sand from Ottawa, Ill. New methods have been developed for cleaning glass sands (30).

Work which is under way or recently completed includes electrophoretic dewatering of clays (32); principles of microelectrophoresis cells (32); an improved mercury balance volumeter (32); identification of alumina-bearing minerals by thermal analysis (28); deflocculation of clay slips (11); influence of base exchange on some properties of clays (12); the pH values of some ceramic raw materials (12); electrically fused forsterite-olivine (32); chromite in Washington (32); development of lime insulating material and acoustic plaster (26); improvement of properties of finishing lime; effect of additives on concrete; investigation of processes involving the use of plaster of Paris; the influence of organic deflocculants on the strength and the life of pottery plaster (12); fabrication of graphite mixes; development of improved coatings for electric arc-welding electrodes (26); and commercial firing survey of car-tunnel kilns (32).

Refractories

The difficulty in obtaining India kyanite started serious testing of American kyanite, topaz, andalusite, diaspore, bauxite, and other high-aluminous minerals that possibly could replace this important foreign refractory material. First, a study was made of the India kyanite, its method of manufacture, and the quality of its products. Comparative tests were made of all known domestic substitutes (32 and others).

The South Carolina topaz is the immediate logical replacement mineral. Its volume expansion on heating is less than that of kyanite, but its porosity is greater owing to the evolution of water and fluorine with silica. The effect of these differences between topaz and India kyanite is still being investigated (32). The substitution of topaz for India kyanite is being investigated elsewhere (12 and others). Topaz has been shown to be the best domestic substitute for India kyanite. Confirmatory service tests are under way (32).

Tests have been made on the absorption of waste gaseous fluorine compounds from topaz produced by the calcining of topaz to mullite (32). Indications are that the fluorine compounds can be converted into insoluble lime salts for convenient disposal. The possibility of recovery fluorine in the form of by-product sodium or aluminum compounds for marketing has also been considered.

It is indicated that fused olivine, altered into pure forsterite, should be a superior substitute for some of the former uses of magnesite. The properties of forsterite derived from North Carolina olivine by electric melting have been made the subject of investigation because of the need of a basic refractory for highest-temperature service as a replacement for magnesites and chromites (28). Large quantities of forsterite-olivine occur in dunite formations in North Carolina. These deposits are well-situated for electric production of forsterite.

Refractory brick made from olivine (dunite) from the State of Washington gave satisfactory service in a test course in the throat of a basic open-hearth steel furnace in place of chromite brick (30, 32). Previously a simulative-service slag test using basic open-hearth steel slag, made to determine the relative resistance of various basic refractories to chemical attack and mechanical erosion, had indicated that brick made of 80% dunite, 10% dead-burned magnesite, and 10% chromite were equal to or better than five different industrial basic refractories.

Service tests of forsterite brick in a copper sulfide reverberatory furnace indicated better resistance to slagging than the silica brick currently being used. The brick used for this panel contained 5% calcium aluminate cement (lumnite) and 5% calcined magnesite. Larger amounts of the cement seriously reduced the refractoriness of the forsterite (32).

The large amount of low-grade southern bauxite represents a potential source of excellent refractory material, which is now being used in comparatively small amounts for electrocast refractories and corundum abrasives. Experiments have been made to reduce the cost of this excellent grog or refractory skeleton material by rapid melting and water quenching instead of slow cooling in large masses (32). The iron impurities in the bauxite are reduced to the metallic state and removed as ferrosilicon, and the freed alumina while molten is mixed with silica to form mullite. This artificial mineral is the same high-temperature product obtained by heating India kyanite, except that the electric-furnace mullite is denser, more rigid, and most resistant.

Considerable continued research has been carried out during the year on development of a dense grog for refractories from Virginia kyanite (17). Densest grogs with the least shrinkage on reheating are obtained with a minimum addition of clay and small percentages of fluxes or mineralizers, such as apatite; talc; a material made up of oxides of alumina, phosphorus, and sulfur; and other phosphates. Other possible uses for this domestic kyanite have also been studied, and these studies are being continued.

The development of a domestic kyanite brick having low after-shrinkage, high resistance to slag penetration, and favorable spalling resistance was carried on and a great deal of fundamental data on the use of domestic kyanites is being accumulated (23).

The properties of fire-clay refractories made by the new Russian developments were studied; 90% grog fired at low temperatures (900° to 1500°F.) was mixed with 10% bond clay, and the brick were dry pressed (12).

By adding the bond clay to grog bodies as a slip in place of dry clay, improvements in properties of the refractory body were produced (12). Organic deflocculents and hot water also produced marked improvements in the properties of bodies without decreasing the refractoriness of the bodies as is the case when inorganic deflocculents are used.

The solid solution of P_2O_5 in calcium orthosilicate has been studied by thermal and optical methods to work out the mechanism of the beta-to-gamma inversion and its inhibition (10). The inversion temperature for the alpha-to-beta C_2S change was lowered by the presence of dissolved P_2O_5. Two types of inhibition of the beta-gamma inversion are recognized, namely, (*a*) physical, wherein the constraint imposed by the surroundings acts to prevent the inversion and to interrupt the continuity of the inversion wave, and (*b*) chemical, wherein the presence of foreign dissolved substances produce an apparent stability in the beta lattice at room temperature. The phenomena are of great importance in certain refractories, slags, and cements.

Phase equilibrium in part of the $MgO–B_2O_3$ system has been investigated, and the corresponding phase equilibrium diagram has been constructed (10). Three intermediate compounds are present: $MgO \cdot B_2O_3$ melts incongruently at 988°C. to form $2MgO \cdot B_2O_3$ and a liquid containing more than 99% by weight of B_2O_3. The other two com-

pounds melt congruently, $2MgO \cdot B_2O_3$ at 1340°C., and $3MgO \cdot B_2O_3$ at 1366°C. At 1142°C., a region of liquid immiscibility extends from 0.6 to 36.0% by weight of MgO.

The spinels $MgO \cdot Al_2O_3$, $MgO \cdot Cr_2O_3$, and $MgO \cdot Fe_2O_3$ and the orthosilicates $2MgO \cdot SiO_2$, $2CaO \cdot SiO_2$, $2SrO \cdot SiO_2$, and $2BaO \cdot SiO_2$ were synthesized by solid-state reaction of the component oxides or compounds yielding the oxides on ignition (6). At various temperatures, each of the spinels was tested with each orthosilicate in turn by placing a pellet of each in contact and by intimately mixing the two. Petrographic microscopy and X-ray diffraction were employed in the identification of reaction products.

The influence of various iron-bearing impurities in fire clay on the disintegration of fire-clay refractories was studied. Special attention was paid to the effect of fineness of the different impurities on carbon monoxide disintegration (12).

The oxidation of iron in iron-bearing silicates is of interest in the manufacture of basic refractories. When a silicate mineral containing divalent iron as a lattice constituent is heated in air the iron is oxidized and rejected from the lattice (10).

The staining of silica brick was found to occur in a critical temperature range of 900° to 1000°C. Concurrently the brick had to be "soaked" and exposed to an oxidizing atmosphere. Stained brick could be "cleaned up" or staining prevented by manipulation of the foregoing conditions as well as by additions of lime above 2.5%. The experimental data examined in relation to the system $CaO–Fe_2O_3–SiO_2$ suggest that the colorant is the mineral dicalcium ferrite.

Some tests have been reported which lead to the conclusion that water vapor has little or no effect on silica brick at temperatures from 2700° to 2900°F.

Control of kiln atmosphere in reheated, load-test, and P.C.E. furnaces has received attention.

An electrically heated load-test furnace has been developed, using an Arsem-type, spiral graphite heating element (32). The novelty of the design lies in the method of protection of the heating element against atmospheric oxidation. No vacuum or special gas atmosphere is used. Instead easily replaceable graphite plates and cylinders inclose the heating element in such a way that oxygen must contact and react with a cheap and easily replaceable protective graphite part before reaching the element.

A spherical calorimeter has been constructed for measuring true specific heat and thermal conductivity. The calorimeter is formed of two concentric spherical platinum shells and is housed in a spherical electric furnace. The sample is spherical and is fitted into the inner shell; heat is supplied electrically at the center of the sample. Thermal conductivity is measured by determining the inner and outer sample temperatures at steady heat flow using the equation of heat conduction in a sphere. Specific heat is measured by noting the temperature rise of the sample with a known heat input while maintainingt he calorimeter shells near the adiabatic condition.

Various brands of the heat-setting type of refractory mortar have been tested with respect to sieve analysis, P.C.E. mixing water, troweling, and drying properties as well as strengths after heating at various temperatures (27).

Other researches on refractories include development work on refractories (26); studies on inversions in silica brick (6); problems encountered in the manufacture of ladle brick; mottled silica brick; development of dry-pressed insulating refractory (15); and service tests on lightweight refractories coated with alumina (12).

Structural Clay Products

The Structural Clay Products Institute has sponsored a joint study on masonry mortars. The investigations were directed toward determining the effects of mortar properties of brick (rate of suction, method of forming, and texture) on bond between mortar and brick. Laboratory techniques have been standardized. One phase of the work consists of a study of the effect of various kinds of brick of varying degree of firing and various mortar consistencies on the tensile strength and other properties of the brick mortar bond (17). Another portion of the joint study deals with the tensile strength of bond and grout to brick (18). Other parts of the program include studies of the effect of properties of mortar on bond (21) and the bond between mortar and steel and the effect of admixtures to the mortar of this bond (6). Other research work on mortars is underway (11, 26, and others).

The Structural Clay Products Institute in cooperation with the Modular Service Association have made studies during the past two years on present unit masonry sizes as used in conventional building construction and their adaptability to a coordinated system. It was found that a significant relationship exists between present unit sizes in height, thickness, and length and a 4-in. modular dimension. There is little consistency, however, in the assembly of these units in similar or composite walls and far less in the coordination with component building materials and equipment.

Recommendations are made for single masonry units based on whole multiples of 4 in. with consideration given to the various joint thicknesses. Methods are shown of relating unit sizes in fractional multiples of 4 in. plus mortar joints to the grid pattern. Suggestions for standardization of unit sizes are proposed to obtain maximum simplification and corresponding economy to meet postwar construction requirements.

Rates of water loss in the drying of brick have been studied under controlled atmospheric conditions (6). The behavior of shrinking and nonshrinking bodies was compared. The changes in rate of water loss with the decrease in moisture content show characteristic stages in the drying process.

Results have been published on the causes and remedies of certain hard-fired brick that meet specifications, influence of deairing on the physical properties of the finished product, and the influence of repeated freezing and thawing and outdoor exposure on the physical properties of zinc-flashed and glazed brick (27).

The weather resistance of glazed blocks has been investigated in accordance with the A.S.T.M. specification (23). It was found that the test as written gives no indication of the excellence of the glazed tile or structural unit. With the object of carrying these tests to a more definite conclusion panels are being erected which will be subjected to weathering conditions. These actual weathering tests are to be correlated with sonic properties, with autoclave tests, and laboratory freezing and thawing tests, in the hope that such data will provide the means of predicting failure before it actually occurs (23).

Studies have been made covering methods of improving the fire resistance of glazed brick and tile, including the redesigning of the core structure and the use of insulating fillers. A similar investigation is started in connection with structural clay tile (23).

An investigation of the sonic properties of paving brick has been started with the object of correlating such properties with the service rendered by these brick as exhibited in a test road built several years ago of the several makes of brick to be included in this study (23).

Work has been completed on new precast concrete units for employment in the construction field (25). The main efforts were directed toward the development of precast units which would have wide applicability in buildings. One of the accomplishments was an insulated lightweight roof panel of low-heat conductivity, composed of concrete and a commercial rigid-type insulating material; this product, on the market for more than a year, has been successfully used in numerous structures. An investigation of manufacturing methods for large structural units, such as precast concrete columns, girders, and hollow floor and wall panels has been finished. Production specifications, based on the experimental work, are guiding full-plant operation on the fabrication of these shapes, whose need by architects and engineers is manifest by the increasing demand for them. The speed of erection of these structural elements is the essence of their utility.

Expanded vermiculite has been studied for use with a low vitrifying plastic clay bond to form structural clayware such as partition tile and bathroom tile which may carry glazed coatings in decorative effects (20). The advantage of this material is its low thermal conductivity, its relatively high strength as compared to its specific gravity, and the ease with which it can be cut and fitted into installations.

A low-fusing nepheline syenite body was developed to which an agent was added that generates a gas at the fusing temperature and evenly bloats the material (2). The fired piece will float in water and, being made up of completely vitrified cells, is not penetrated by water during continued soaking. This type of body has possibility in the making of a product similar to lightweight glass brick.

Other researches on structural ceramics include service tests on building brick (12); lightweight refractories; efflorescence tests (12); salt-glazing (23, 26); hollow-wall construction; durability of concretes and mortars; and precast clay product floors.

Whiteware

Reference is made to the report of the Research Committee of the United States Potters Association, which summarizes the research on whiteware during the past year. This Association has sponsored a research on leadless glazes because of the possibility that lead may become a restricted material and also because of its general interest (23). Some rather promising glazes have been developed in this study which will be tried on a larger scale.

The restrictions imposed in regard to the use of such glaze materials as cobalt oxide, tin oxide, copper oxide, and zinc oxide have hampered parts of the industry, but body materials have been quite readily available. The attempt on the part of the English government to cut off the importation of English china clay does not seem to have become effective as yet. The raw material producers are handicapped by labor scarcity; for example, the feldspar output of North Carolina is hampered by labor shortage due to the intense production of mica required by the war effort. Nepheline syenite is assuming a more and more competitive position in regard to feldspar. The domestic supplies of kaolin and ball clay are ample. The flint situation is, of course, unchanged.

An investigation, first proposed by the Research Committee of the Association, has been continued during the past years on the introduction of nepheline syenite in place of feldspar (23). The greater fluxing power of nepheline syenite can be utilized by lowering the firing temperature or by lowering the auxiliary flux, such as dolomite or whiting in vitreous bodies.

A low-temperature porcelain was developed with nepheline syenite which is different from any porcelain yet made (23). This type of porcelain carries large proportions of nepheline syenite (from 52 to 88.5%) with no flint. Small amounts of bentonite are added to increase the plasticity. Vitrified bodies of this type can be produced between cones 3 and 4. The resulting bodies show a high degree of translucency and fire quite straight. The ware will take a more brilliant decoration as the maturing temperature of the glaze is much lower than that of European porcelains. When small amounts of flint are added the thermal expansion is increased markedly. When American clays are used the bisque-firing temperature has to be increased by one cone. The fired strength of these bodies is adequate and the firing range is good. Considerable work is being done with bodies of this type in the industry. Primarily, these bodies were intended for single firing. For flatware, satisfactory glazes should be developed which mature at a lower temperature than the body. Good results have been reported to date commercially; more work is being done, however, on such low-temperature glazes (23).

A number of semivitreous manufacturers have entered the field of production of vitreous ware for the services. This has led to a general interest in vitrified products, and a large amount of experimental work is going on, ranging from low-fired china to high-fired porcelain.

The properties of vitreous ware under different firing conditions were studied (23). On repeated firings the body became slightly more absorptive and showed a slight expansion and an increase in strength, but one or two refirings caused insignificant changes. A shorter firing time and a higher temperature permitted less quartz solution and mullite development than longer firing and a lower temperature. Higher temperatures and faster firing caused greater strength.

Rapid firing caused a lower thermal expansion, and a lower firing rate resulted in higher values. This evidently is connected with the formation of glass in the body and the solution of the quartz grains. The expansion of the vitreous body was decreased progressively as the temperature was raised.

The glaze, like the body, has a lower expansion at the higher firings. The thermal history has a marked effect on the glaze stress. A lower cone temperature resulted in lower compression. As the compression of the glaze increases, its mechanical properties are improved. For any given body and glaze one best set of firing conditions exist which should be determined.

Also studied was the thermal history of semivitreous bodies where it was found that higher firing decreases thermal expansion and that the strength decreases with increasing absorption. In steam, test plates fired to a higher temperature had less resistance than those fired to a lower heat. But higher firing reduces the moisture expansion. It was claimed that differences in moisture expansion are less important than those of thermal expansion. A higher glaze compression results on bodies fired to a lower cone temperature or on those with a higher body expansion. Longer and higher glost firing is beneficial to the amount of glaze compression and hence to the crazing resistance.

The bisque firing temperature had little influence on the hardness of the glaze. It is a curious fact that the hardness varies for different portions of the same piece. The heavier the glaze coating the less its hardness.

The influence of the particle size of flint in earthenware bodies has been studied. It was found that the moisture expansion of bodies was definitely decreased through the use of finer flint, and, at the same time, the thermal expansion was increased. In addition, it was found that the low temperature inversion of the flint was greatly affected by its particle size. Thus, coarse flint causes a low rate of expansion between 302° and 338°F. and a high rate at 1076°F., whereas fine flint has a high rate of expansion from 302° to 338°F. and a low rate at 1076°F..

Investigations have been reported showing the particle-size variations of commercial shipments of flint and feldspar as possible causes of production variations in whiteware bodies (23 and others). The Andreasen pipette has been used in most of the tests, although the hydrometer method has been used in comparison to develop a more rapid procedure for commercial usage. Feldspar was found to be markedly affected by the type of suspending medium used, and it apparently has active surface characteristics which permit it to be flocculated or deflocculated. Sieve tests were found to be unreliable for commercial feldspars and flints.

The introduction of fluxes like spodumene in addition to the feldspar seemed to yield results of no practical importance. Many attempts have been made to produce new ceramic materials through the use of small amounts of various reagents in the hope that some mysterious change might transform the ceramic bodies into some new and startling product. Unfortunately, compositions represent such sluggish, highly viscous systems, so far from fluidity that not much can be expected from such attempts. The effect is usually proportional to the amount of a constituent used, and catalysts, which are so important in many fields of chemistry and metallurgy, cannot be used.

In regard to glazes, the use of substitute materials as, for instance, in the replacement of tin oxide by zirconium oxide and its compounds and by cerium oxide, has been investigated. Zinc oxide has been removed from many glazes and cobalt oxide has not been replaced, though certain blue colors can be obtained from combinations of

cerium and uranium. Copper oxide also has been eliminated.

Considerable study has been given to certain factors in glaze slip control (6). The investigation was directed toward the satisfactory application of the coherence test, together with some measurable body properties, to the more general problems of glaze slip behavior and control. An attempt was made to correlate the thickness of deposition of glazes on bodies with the air permeabilities of the bodies and the consistency of the slip measured by the coherence method. This correlation was satisfactory under certain restricted circumstances but not for general use. A satisfactory correlation, independent of the type of body, between glaze consistency (coherence values) and water receptivities of the bodies was obtained.

Further work has been done with the "pick-up method" of glaze slip control. Additional types of glazes have been studied, and improvements in technique and apparatus are described. The correlation between glaze consistency, body receptivity, and thickness of glaze deposition may be represented by a simple first-order equation having two constants; that is, $PK\left(\frac{R}{100}\right) = (C\text{-}0.002)$, wherein P = pick-up, K = deposition constant, R = receptivity, and C = coherence value.

Coherence values, measured by the amount of slip adhering to a glass plate when withdrawn at a uniform velocity from a reservoir of slip, have several practical applications. Coherence-value measurements may be used (*a*) to check incoming raw materials, (*b*) as a basis of selection of certain raw materials, (*c*) as a control test to determine the constancy of slip consistency, and (*d*) as a control test at any point in the processing of slip. By correlating and associating coherence values with other factors, a remedy will be evident if the slip is off-standard. The measurement of receptivity is a simple test; it is useful for determining the constancy of the processing and will provide a useful check of the suitability of the ware for glaze application. These methods of testing hold promise of general application in fields other than glaze control.

Work has continued on the subject of glaze fit (6, 12, 23, and others). The influence of glaze penetration on glaze fit has been studied noting the effect of different oxides when used in the RO of a base glaze on the penetration and reaction of these glazes with various bodies. It is claimed that such penetration tests often indicate which type of glaze is best suited for different bodies. Some effects of crystallization on glaze fit have been studied (6).

A study has been undertaken of the scratch hardness and abrasive resistance of glazes and the effect on its improvement of additions of such constituents as beryllium oxide (23). In this investigation it is planned to make a critical study of methods of producing and properly measuring the scratch resistance. It is hoped that the use of the electron microscope, through the medium of surface replicas, will prove to be of value in this connection.

An investigation was undertaken to develop new uses for strontia, which is being produced in large tonnages but which is now limited to war use (23). A study of its use in ceramic glazes was begun and some promising results have been indicated by laboratory trials. Plant trials will soon be carried out.

Work has been done on the development of conducting glazes for insulators (12). Considerable radio interference is caused by electrostatic charges which collect on the surface of electrical insulators and which tend to spark over when this becomes too high. By applying a conducting glaze to those portions of the insulator in contact with the line and tie wires, the electricity is conducted into the porcelain and thus prevents the accumulation of a static charge on the surface of the insulation.

The effect of manufactured gas upon glazes and decorations has received attention. It was found that blistering of the glaze resulted owing to the presence of hydrogen and carbon monoxide which did not occur with natural gas. It would seem possible to adjust the gas-air ratio to prevent the occurrence of this glaze defect. It was also found that in the use of manufactured gas sulfur dioxide infiltrations must be prevented. It was estimated that only 3 parts sulfur dioxide per million could be tolerated within the muffle between the temperature range 1200°–1600°F.

The term, Prestite, implies a new method for the manufacture of absolutely vitreous electrical porcelain. The Prestite method involves pressing of ceramic compositions in metal dies under specially controlled conditions. Hydraulic presses are preferred for use with the Prestite process. By the proper application of ceramic materials to the die, evacuation of the specially sealed die, and controlled manipulation in the application of pressure, nonporous ceramic ware is produced. Ceramic ware formed in steel dies possesses greater dimensional fidelity than is practically possible with other methods and, in addition, quite intricate shapes may be produced. The fact that these advantages may be coupled with the production of nonporous ware from a variety of body compositions makes the Prestite method of manufacture commercially useful.

Tests have been conducted to develop ceramic bodies with high heat-shock resistance so that cooking ware made from these bodies may be used for top-of-stove ware as well as ovenware (12).

In a general program on the use of phosphorus in ceramics, several whiteware bodies were developed which consist of apatite and/or monazite as crystalline phases bonded by multicomponent phosphate glasses (10). Bodies of this type can be obtained practically free of alkali and they are suitable for electrical insulators.

A study has been made of the soluble sulfate content of pottery bodies (32). A method of analysis was developed that gave consistent results for soluble sulfate and total soluble salts in ceramic raw materials and bodies. Values for sulfate upon a dry-weight basis ranged from 0.01 to 0.28% with ball clays, from 0.002 to 0.015% with china clays, and from 0.000 to 0.007% with miscellaneous raw materials. Bentonites were relatively high in sulfate, a Wyoming bentonite showing the highest value, namely, 0.194%.

The distribution of sulfate in the slip, cake, and press water was determined for eighteen ceramic bodies. An increase in the water:clay ratio in slips was found to increase the recoverable soluble sulfate. In experiments on repeated conversion of cake to slip and then filter-pressing, the release of soluble sulfate continued, but the bulk of the sulfate was obtained in the first pressing. Quantitative results were determined on the effectiveness of barium carbonate as a precipitating reagent for sulfate in slips.

Aging from 6 months to 1 year had little effect on the soluble sulfate in stored samples of slips, cakes, and press waters. Aging for 6 months, however, doubled the soluble sulfate content of a freshly mined ball clay, evidently through oxidation of sulfur compounds. This study is of practical interest to all engaged in casting chemical porcelain, electrical insulators, and general chinaware.

A study was made of the deformation characteristics of pyrometic cones. This investigation had to do principally with a study of the glassy phase under different heat-treatments using bodies containing the different minerals that are found in the various cone batches (23).

The possibility of making grinding balls for ball mills from a nepheline syenite body was investigated. These balls were found to be slightly more abrasive-resistant than the porcelain balls now on the market (23).

A study of the electrical conductivity of high-alumina spark-plug bodies has been made (6). Other researches include special spark-plug compositions (1); relation of talc grain size to firing shrinkage of steatite bodies (7); investigation of multilayer bodies (6); quantitative determinations of glassy phase in ceramic bodies; deflocculation and coagulation through addition of salts to plaster molds (11); study of warpage of plates (32); influence of mineralizers on quartz-tridymite transformation (8); and duplication of chrome-brown electrical porcelain glazes with nonessential materials (8).

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(20) Department of Chemistry, University of Texas, Austin, Texas.
(21) University of Wisconsin, Madison, Wis.
(22) Engineering Experiment Station, University of North Carolina, Raleigh, N.C.
(23) Engineering Experiment Station, Ohio State University, Columbus, Ohio.
(24) Engineering Experiment Station, University of Illinois, Urbana, Ill.
(25) Mellon Institute of Industrial Research, Pittsburgh, Pa.
(26) Battelle Memorial Institute, Columbus, Ohio.
(27) National Bureau of Standards, Washington, D. C.
(28) U. S. Bureau of Mines, Washington, D. C.
(29) Southern Experiment Station, Bureau of Mines, Tuscaloosa, Ala.
(30) Northwest Experiment Station, Bureau of Mines, Seattle, Wash.
(31) Eastern Experiment Station, Bureau of Mines, College Park, Md.
(32) Electrotechnical Laboratory, Bureau of Mines, Norris, Tenn.
(33) State Geological Survey Division, University of Illinois, Urbana, Ill.

—ARTHUR A. WELLS, *Chairman*
JOHN H. KOENIG, *Secretary*

REMOLDING OF ART DIVISION INTO DESIGN INSTITUTE*

MR. MCAFEE: Mr. President, early last year I made some suggestions to you as an individual member of The Society, not as Chairman of the Rules Committee, in regard to the perennial "Problem of the Art Division." We spent half a day on this problem the last time The Society met in Pittsburgh in 1933. My suggestions were prompted by considerations as a member of Vic Kelsey's Committee on Nonmember Registration. Fees for Art Division members was one of the many-sided phases of that problem.

As I understand it, one of the fundamental problems of the Art Division is that most of its potential membership is made up of persons who cannot, or will not, justify their paying $12.50 annual dues. They will attend meetings of the Art Division if the Annual Meeting of The Society is held close to home. Five dollars looks high to them for registration, especially if they only attend one or two days. Yet these people can make a definite contribution to the development of ceramic art. Possibly we, as technologists, would greatly benefit from their contribution and could well afford to encourage them. Maybe we suffer because the artistic appearance of our products has not kept pace with technical improvement. This would be true more especially in products other than those that are purely utilitarian and functional, but might help even the latter.

We should decide, as a matter of policy, if we think it is sufficiently valuable to us and to our members to foster the development of ceramic art to the extent of staking the Art Division. If we are convinced we should do this, it is possible to create for them another grade of membership, e.g., the Art Membership which could carry with it a lower rate of dues and lower registration fees. Members of that grade would have the privilege of attending meetings of the Art Division but would not participate in other activities of The Society, such as other meetings, voting, holding office, etc. It would be impractical, of course, to try to exclude them from the social functions of the Annual Meeting. They probably would not receive all publications issued by The Society. It is easy to create this change in setup.

The agenda for this meeting states Class instead of Division because, under the present setup of The Society, we cannot treat Divisions differently, but we can Classes. Any grade of membership in The Society is the only restriction on membership in a Division. Membership in a Class may be restricted in any constitutional way its members may decide. If we are going to give the art group a "stake," let us quit worrying about this "problem" and let the Art Division stand on its own feet as best it can, like any other Division.

PRESIDENT TROSTEL: Mr. Weldon, the new Chairman of the Art Division, will tell us which way the Art Division is going.

MR. WELDON: Mr. President and Board of Trustees: It is a privilege to be here this morning.

The Art Division apparently has been a "pain in the neck" to this group for a period of years mainly because it has lacked a vigorous program throughout the years for the industry as a whole. We should solicit the support of the entire industry. In other words, I think our setup is wrong.

I have been milling this thing over the past few months. In fact, I have been milling it over for twenty-five years. I joined The Society a few years ago from the insulator industry, yet I have a design interest. I am known in the world of art as a designer, and a great many of my specimens are now on royalty and used by the potteries.

There is a place for art in postwar planning. We lack being known among the architects. The designer of this room who used so much glass never heard of The American Ceramic Society. I called on an architect not so long ago and asked him why he did not use more enamel in his building. He said, "To tell you the truth, Mr. Weldon, I do not know how to put it up. The enamelers never told us the method for putting it up and whether lead washers should be used."

The Art Division should be reorganized and should have a board composed of one member from the glass, the

* Remarks at Board of Trustees meeting, The American Ceramic Society, Pittsburgh, Pa., April 18, 1943.

enamel, the whiteware, and the structural clay products industries to help us shape up programs and papers of a more vigorous nature which could be published and in turn circulated by the industry. In other words, we have had in the past a predominance of persons who are interested primarily in craft pottery, and the ceramic picture as a whole has been left out.

I am hoping to take this case before the United States Potters' Association and discuss with them why we do not have more men from the pottery industry in The American Ceramic Society. Where are the moldmakers and the designers? In other words, I came in this Society to meet the whiteware designer and yet I have never been able to find him. Fred Rhead died before I could get acquainted with him.

With your help we must organize some scheme to make this a more vigorous Division. We do not want to sweep art out. If this postwar planning is to come into the picture, the use of ceramics should come through the Art Division, and the Art Division should be the integrating agency to discuss all kinds of problems, such as labor, apprentices, costs, and advertising. I talked recently with a large dealer in fine artware in Rochester, N. Y., and he told me what he disliked about American dinnerware and why he was in favor of European dinnerware. That is the type of man we should bring into The American Ceramic Society Art Division to tell us what is wrong, if anything, with our dinnerware. No doubt this dealer has been unimpressed by our domestic producers. The same thing is true with the architects. The architects in America have been ignored in the present setup.

The Art Division must function for the industry as a whole and incorporate more practical things in its papers and in its meetings through the years and work with men from the Enamel, the Glass, and the Structural Clay Products Divisions.

This Society is one of the oldest technical societies in the United States and it is one of the most vigorous. We are entitled to press releases from our central office which could not be published in the daily press. The art approach is unlimited. By art approach I mean the use of glass and enamel in the architectural field and the possibilities of enamel conductors or enamel stovepipes. These are all part of art.

Look at what has taken place today in the cooking-ware industry. Five of the leading insulating people have entered the porcelain cooking-ware field. What will that do? It will raise the demand for ceramic cooking ware. The department stores, through their research, have discovered that it cleans better. It uses less grease. As a result, we are producing in our plant today over a $2,000,000 contract, supplying the trade with a highly vitrified product.

Those are some of the things that should be discussed—the economic problems in the Art Division. One man cannot do it alone. I hope we can work that out with the Board composed of three or four of the leading groups to help us form our plans so that we will make an outstanding contribution.

The possibilities of the Art Division are tremendous. It has not been scratched yet. It has always lacked a practical program for the industry as a whole. That is how I see it. I was trained originally as an architect. I entered this field through the archeological side and through the mineral field, and that gives me a background for discussing the situation, and I have had a good reception with such groups as the American Institute of Architects.

I would like to cite a story of what happened a few years ago when the Indiana limestone industry collapsed. They were absolutely out of the picture. What did they do? They formed a board and went to the American Institute of Architects and said, "What can we do to get our material back?"

The American Institute of Architects' suggestion—and this is a tip to enamelers and glassmen alike of the possibilities for molding public opinion—was that they have a competition. They would set up a fund of approximately $25,000 and ask architects to design small houses using Indiana limestone. First, the Indiana limestone people were to convince the architects that their house was in order and that they could produce a wall three inches thick and cheaper per square foot. The economics were sound. What happened? Within ten years the country was flooded with Indiana limestone bank buildings. Every city in the country had them because the Indiana limestone people sold the idea to the architects. The glassmen and the enamelers were pushed out. Two of our largest skyscrapers were covered with Indiana limestone. If the glassmen had been on the job, it could have just as well been glass.

Such possibilities in long-range planning should come through and by the Art Division. We have missed that through the years simply because we are 100% technical and not at all economic. The Art Division has untold possibilities in that particular field.

PRESIDENT TROSTEL: Mr. Weldon, do you think the Art Division requires any special consideration in the way of reduced dues?

MR. WELDON: None whatsoever. There are certain arty groups that think they should have elaborate magazines published once a month. If we should start that, the glass people would want one as well as the enamelers. The activities of the Art Division should be most largely industrial, getting something for the industries as a whole. Once a year we should hand in a report of what we are doing and why we are doing it. We should have papers dealing with the economic side of ceramic-ware uses and naturally the art would follow. Art is a broad term. There is a tremendous amount of work to be done to educate ourselves and the public as to the merits and possibilities of various ceramic products. We should look forward to postwar planning and be a strong educational group to force ceramics into the national picture. This can be done more effectively through the Art Division with the right kind of papers and the right kind of help.

One other suggestion we had in mind is that papers dealing with glass or enamel should not be read in the Art Division but in the other Divisions. In other words, the Art Division should sponsor papers read on the programs of the Product Divisions. The Art Division should spread itself throughout the whole Society. For instance, a special paper by an architect on the possibilities of glass should be read before the Glass Division. Certainly the glass technologist should hear such a paper without being required to come to the Art Division and miss papers on glass technology. That paper should be scheduled along with the technical papers. I may be taking in too much territory. This may be a new approach to the whole subject.

MR. FLINT: Mr. Weldon is enough of a Bolshevik that I think he should get some help. When we established Classes we only had one activity at the time, namely, the engineers. We now are considering the designer. Some of these which he is mentioning might fit more broadly into a Class rather than a Division. In other words, if we have an Art Class rather than the Art Division, we can reach through to the other Divisions just as he is suggesting, and they can present papers that are strictly art papers in an Art Division.

If the President would appoint a committee to consider this, if Mr. Weldon would desire it, they could very well formulate and advise the art members of the possibility and probabilities of it and they could then apply for Class representation on the Board and open up the channels necessary to function accordingly instead of just trying to do it as an Art Division. We have talked this over off and on for several years.

MR. HEATH: The Division could benefit by having rather definite objectives, probably some it has lacked in the past. Postwar planning definitely offers an objective. At the present time, we are greatly confused about what postwar housing is going to be. A great many glamorous but undeveloped and unimproved ideas are being thrust at us, so much so that the prospective buyer is going to wait and see. He is not going to buy what we have to offer for several years after the war. We are postponing our own markets. Organized groups in the building industry are

now endeavoring to wrestle with this problem and are trying to do their advance product thinking within their own doors, but mold public opinion to something they might have to sell and thus build their markets intelligently.

We might have a parallel there for the Art Division, and its thinking could guide the other Divisions in product design that would help us build a postwar market more quickly.

PRESIDENT TROSTEL: Some of us thought that the great problem of the Art Division was to find itself, to find some long-range objectives, and it would appear from Mr. Weldon's discussion this morning that something of that sort is filtering down into the personnel of the Art Division.

DR. HOSTETTER: The Art Division has been kicked around for some years. I remember, perhaps you do, too, President Trostel, that in 1933 when I happened to be President this was one of our problems. In analyzing the situation then it seemed to me it was almost inevitable that there would be difficulties with a division such as the Art Division and, I might also add, the Materials and Equipment Division. These difficulties arise from our sectional classification in The American Ceramic Society. We are set up primarily as Product Divisions, whereas a Division such as the Art or the Materials and Equipment, or possibly a Division such as fuels and combustion, we may call functional. These, therefore, cut across the activities of all the other Divisions. The Art Division has suffered because of this setup: What is everybody's business is nobody's business. I am delighted to see that such an energetic proponent of the Art Division is now coming to its rescue with a definite plan of action.

After all, we are bound together as a ceramic society by those things that are common to all of our activities as ceramists. I think that in my annual report for 1934 you will find a paragraph on this subject, pointing out the difference between a functional and Product Division. Also, I recall that there were some recommendations to the effect that the Annual Meeting might well be primarily functional and the summer meetings devoted to the Product Divisions. Now there may be something in that thought. It has been one of the handicaps of the Art Division that it does cut across all of the other Product Divisions. Certainly we in the Glass Division know that art enters extensively into the picture. Here, however, we have Art set up as a Division, functional-wise, and we are trying to fit it into our present scheme of Product Divisions. This may call for a rather fundamental change in our Divisional setup if we are to operate smoothly and effectively. The problem of the Art Division is one that affects the entire Society.

I would like to add, however, that had I been in 1934 the salesman that Mr. Weldon undoubtedly is, we probably would have worked out something at that time.

MR. MCAFEE: I might call attention to the fact that it was largely on account of the recommendations of Dr. Hostetter at that time that the Class setup was created to recognize this functional cutting-across. The change was stimulated particularly to form a champion for our ceramic engineers, but we also had in mind that it would be equally applicable for other groups. We now know we did not provide help for the ceramic engineers soon enough. To keep the Classes from competing too vigorously with the Divisions, provision was made to prohibit them from presenting technical papers as such. Mr. Weldon has made my face even redder than usual. My suggestion was very nebulous, but he has made a similar one that is definite, and he is prepared to go some place with it. I would like to withdraw my suggestion, and let Mr. Weldon go his gait with or without the help of the Board of Trustees, as he may desire.

DEAN HOLMES: Mr. President, should we not have an Institute of Ceramic Designers and an Institute of Ceramic Technologists as well as an Institute of Ceramic Engineers?

PRESIDENT TROSTEL: From the discussions we have had off and on it would seem that the idea is worth consideration.

MR. FLINT: I move that the President appoint a committee after talking with Mr. Weldon on what he wants in order to develop his idea of an institute that may suit the situation.

PRESIDENT TROSTEL: Is there a second to Mr. Flint's motion?

MR. KELSEY: I would like to make a statement along that line. It seems to me, Francis, that your motion may include a little more. We heard a great deal this morning about advertising and publicity propaganda. Heretofore that has been somewhat scorned or not accepted too readily, but there is a place in this Society, in my opinion, for a public relations setup of some sort just as much so as Mr. Weldon has stated with respect to the practical aspects of art in the ceramic industry, and you might just extend or give consideration along that line.

MR. FLINT: That could be included when they get together.

MR. KELSEY: That would be very good because you have a public relationship here now with the Selective Service Board and we were not set up very well to handle it at the beginning. Perhaps now it is functioning just as well as it could function and the Public Relations Committee would consider postwar planning and even something that is more immediate in the way of taking care of the present setup of the ceramic departments in the various colleges and universities. When these problems come there is always some way to work them out if we can just find the right thing to do.

MR. TROSTEL: In view of Mr. Kelsey's remarks, do you wish to restate your motion?

MR. FLINT: My motion is general enough to include that. Mr. President, I stated that motion generally because I personally would like to see an institute formed to function much as the engineering Institute has done. They have gone a long way outside as well as within The American Ceramic Society. I put it as I did, acquiescing to Mr. Weldon, because he has brought in some concrete ideas which could very well be incorporated. If you would appoint a committee, it would undoubtedly have designers on it, and Mr. Weldon's ideas could be worked into it. In talking it over, they may decide that the situation does not warrant an institute. The main idea is to get some action and bring it to a head.

PRESIDENT TROSTEL: Is there a second to the motion?

MR. KELSEY: I second the motion.

(The motion was put to a vote and carried.)

CLASSES VERSUS DIVISIONS

Communication by Major E. Holmes Dated April 26, 1943

Last Sunday at the Board of Trustees meeting I suggested that the Art Division be made an Institute of Ceramic Designers instead of a Class, and later somebody moved that it be done, and it was adopted. Still later, I spoke on it at the Art Division meeting and I believe the membership of the Division will support the idea as presented by Mr. Weldon.

This, however, is only part of the proposal that I want to make and hereby put in the record. I want to predict that within a few years The American Ceramic Society will consist of The American Institute of Ceramic Designers, The American Institute of Ceramic Technologists, and The American Institute of Ceramic Engineers, instead of the present multiplicity and complexity of units. Furthermore, I want to recommend that it be done and I would appreciate the privilege of presenting the plan at the next meeting of the Board of Trustees. This would be the logical culmination of the remarkable growth, development, and evolution that The American Ceramic Society has undergone since you (Ross C. Purdy) became its Secretary, and I think that the plan would take care of most of The Society problems.

At present, The Society consists of Divisions, all of which carry on simultaneous programs crowded into a four-day Meeting. In recent years numerous other activities and programs have been added, including the activities and programs of the Ceramic Engineers, Fellows, alumni meetings, Orton Lectures, Keramos, the Ceramic Educa-

tional Council, and others that are adding to the complexity and confusion instead of simplifying it. One leaves the Meeting in a confused state after having tried to attend and participate in all of these activities. Many find that they have spent much of their time at the Meeting running about from one Division to another trying to hear the particular papers they want to hear and still lose out on many of them. The posting of the papers on the Bulletin Board helps but does not solve the problem. As a result, many confine their attendance largely to one Division and miss papers in other Divisions that may be of more importance to them than some of the papers they hear in their own Division.

But that is only a small part of it. There are many like myself who because of the nature of their own work or job cannot possibly confine their interest to one Division or should not do so. In my case as Dean of a college that teaches design, technology, and engineering, I cannot confine my interest to one Division but must be interested in all of them, and it would be better for The Society if everybody had a broad interest instead of a narrow one. As will be apparent, my plan would take care of this situation and would abolish the present iniquity of having one's standing in The Society being determined by the opinion of one Division.

An additional and more important consideration is that now that the engineers are already organized into an Institute, the technologists are left out in the cold, so to speak. It was a highly constructive move to establish the Institute of Ceramic Engineers and now it would be a highly constructive move to organize the Institute of Ceramic Technologists. Many of the most valuable members of The Society are scientists and technologists and are not eligible for the Institute of Ceramic Engineers. They should not be neglected but should be recognized on the same basis as the Engineers, and that should be accomplished by having an Institute of Ceramic Technologists. Its membership would be large and it would be as important as the Institute of Ceramic Engineers. It would bring in a large number of so-called chemists who are not now recognized by the federal agencies as ceramists, although they are doing ceramic work.

To fulfill its natural and logical function, The American Ceramic Society must promote ceramic design, ceramic technology, and ceramic engineering. All three are essential in the industry and in the profession. The present tendency is for engineering to crowd out the other two. I am not arguing for less engineering, but for more design and technology.

There is a large untapped reservoir of membership in the field of design and technology that could be brought into The Society by recognizing the two Divisions through the establishment of the two additional Institutes. The important thing is that The Society as a whole should be made strong instead of being concentrated into one narrow field or objective.

There are, of course, many other considerations that I cannot bring out in this letter, but coming briefly to the point, I want to recommend that the present Divisions and units of The Society be replaced by the Institutes of Design, Technology, and Engineering, and that the programs of the Annual Meeting consist of the three programs of Design, Technology, and Engineering, and of them only. Furthermore, the management of The Society would be lodged in an Executive Committee of the Board of Trustees consisting of the President, Secretary, Treasurer, and the presidents of the three Institutes.

Communication from W. Keith McAfee Dated May 26, 1943

Before commenting on the proposals of Dean Major E. Holmes in his letter of April 26, I would like to set forth my own conception of The American Ceramic Society now and during the last twenty years.

I understand that during the life of The Society prior to 1922, or thereabouts, there were no Divisions and the Product Division setup was made about that time. (I joined The Society in the fall of 1922.) The membership divided itself into these groups or Divisions so that they could spend part of the Annual Meeting discussing the peculiar problems of their group. Methods of manufacture were different, products were different, and service conditions and problems were different. The only common denominator was fundamental ceramic technology.

Our programs have developed over the years since then with approximately one day of general sessions (for the common interests) and two days of Divisional meetings (for the peculiar interests). The two days have not proved to be enough, and we have stayed at the Annual Meeting through part of Thursday and even had interim or "summer" meetings for some of the Divisions. We have done this because we did not want to give up our general sessions.

Of late years we have seen more and more half-day joint sessions of two or more Divisions where some program was fundamental enough to interest more than one group. As our fundamental technology increases, the emphasis will shift from the Divisional meetings to the general meetings. As the products of the ceramic industry are so divergent in character and application, it would seem that there will always need to be some sort of product grouping to take care of the reduction to practice of our fundamental knowledge, and this is one of the principal duties of our Society.

Many groups with special interests have grown up in connection with our Annual Meetings and more or less attached themselves to The Society. Keramos, an engineering fraternity with chapters scattered over the country and alumni scattered through the industry, finds it convenient for its members to meet at that time. The Ceramic Educators nearly always attend the Annual Meeting of The Society. It is most convenient for them to meet together at that time. It is the easiest time for all to have alumni reunions.

Then came an idea of organizing a Materials and Equipment Division and an Industrial Management Division, the latter to interest those members who had "progressed" to more executive and less technical positions, but who okayed expense accounts and advertising budgets. The Materials and Equipment Division was organized, but those promoting the Management group realized the possible conflict with the Product Divisions and asked for, and got, a Standing Committee instead.

In the meantime the registration of engineers became more and more important. The Engineers Council for Professional Development was organized by five engineering societies and the organization of state board examiners to improve the professional standing of all engineers. One of the steps undertaken by E.C.P.D. was the establishing of standards for engineering schools and the accrediting of those schools that met them. They also set forth standards for requirements of full membership for engineering societies.

The ceramic engineers had no organization to fight for their place of recognition with E.C.P.D. and its program. Such a group was ready to organize but wanted to do so within the structure of our Society. After considerable study, the idea of the "Class" subdivision was conceived and the necessary machinery provided by amending the Constitution and By-Laws of The Society. It was recognized that this would also provide machinery for the ceramic educators' group to formally organize, and that it might, at some future time, solve the perennial problems in connection with the Art Division. The ceramic technologists might also organize, if sufficient reason for it ever developed and if any one could ever define them (it is hard enough to define a ceramic engineer). This original conception is borne out by the setup of the present Committee on Ceramic Education (By-Laws Article B XII, Section (10), page 390, October, 1938, *Bulletin*).

Let me quote the Constitution and By-Law provisions establishing Classes and Divisions:

"Article VIII (1): Fellows and Members may be grouped into Classes according to their training and experience, as provided by the By-Laws.

"Article B VIII (1) (*a*): The Classes of THE SOCIETY shall be as follows:

"(*i*) The Institute of Ceramic Engineers, an affiliate of THE AMERICAN CERAMIC SOCIETY.

"(*ii*) The Ceramic Educational Council, an affiliate of THE AMERICAN CERAMIC SOCIETY.

"(*b*) Additional Classes of THE SOCIETY may be constituted by the Board of Trustees by amending Subsection (1) (*a*) above on petition as provided in the Rules.

"Article R VIII (1) (*b*): Petitions requesting the organization of additional Classes of THE SOCIETY shall be addressed to the Board of Trustees, and shall be signed by at least twenty (20) Fellows or Members in good standing.

"Article VIII (2): Each Class may elect officers and conduct business as provided in the By-Laws.

"Article B VIII (2): Each Class shall have power to make such Rules, elect such officers, and conduct such business as a majority of its members may deem proper, subject, however, to the Constitution and By-Laws of THE SOCIETY. They shall have no technical sessions nor present papers as a Class.

"Article R VIII (2): The Board of Trustees shall make the final decision of questions of conflict between the Rules of a Class and the Constitution, By-Laws, or Rules of THE SOCIETY.

"Article X (1): Divisions of THE SOCIETY shall be such groups of members as the Board of Trustees may authorize for the purpose of stimulating the growth and activities of THE SOCIETY in particular Divisions or branches of the arts or sciences of ceramics.

"Article B X (1) (*a*): The Divisions of THE SOCIETY shall be as follows . . . .

"(*b*) Additional Divisions may be added by amending Subsection (*a*) above on petition as provided in the Rules.

"Article R X (1) (*b*): Petitions requesting the organization of additional Divisions of THE SOCIETY shall be addressed to the Board of Trustees, and shall be signed by at least twenty (20) Fellows, Members, or Voters of Corporation Members in good standing.

"Article X (2): In order to qualify to vote for Trustee representative of a Division or for Division officers, each voting member of THE SOCIETY shall enroll in one particular Division. With the exception of the right to vote, members of THE SOCIETY shall be accorded equal privileges by all Divisions.

"Article B X (2): Each Voting Member shall instruct the General Secretary in which Division he wishes to be enrolled for the privilege of voting. Such Division affiliation may be changed by the Voting Member by notifying the General Secretary."

We have really had a policy of officially recognizing certain of those groups who have reason to gather together at the time of the Annual Meeting. The Institute of Ceramic Engineers has only one purpose, and it is doing what it can in that direction (more economically than it could alone). The Ceramic Educational Council has its own work which it is carrying out. Neither interferes with The Society except for the difficulty of fitting them in the Annual Meeting program. Keramos or the alumni groups are clearly not the affair of The Society.

Now comes the problem of the Art Division which was discussed at the Trustees meeting in Pittsburgh and a committee appointed with Walter Weldon as Chairman. Disregard my suggestion of last summer to make this Division a Class along with a special grade of Art membership, because I think we all believe Walter has a better idea.

His proposal is to make what was the nucleus of the Art Division a real service organization to the Product Divisions and to the whole ceramic industry. Technical papers would be given in the appropriate Division or in general sessions. The object would be to promote ceramic design and to furnish the necessary ammunition to publicize ceramics to the public. There are those (and myself among them) who believe this is a little out of the proper activity of a technical society. Any of us who have had anything to do with trying to establish our rightful position with the War Manpower Commission know that our industry, as a whole, has not gotten itself across to the public. We are not even properly defined in the dictionaries. Our Society is the only organization that covers the whole industry and the only one that can do the job, so let us not quibble about fine distinctions and get to work.

Under our machinery this could be carried out either by a standing committee or by forming those of the art group who are interested into a Class. This latter gives more stability and strength to the project and is the course that has been decided upon. The Art Division, as such, will pass out of existence.

I am quite sympathetic with Major Holmes' program and believe that some day it, or one much like it, will be carried out. If it were forced at this time, we would lose much of our membership. As I pointed out before, product groups are necessary for promoting the application of ceramic technology. A majority of our members at present are not broadly enough interested to hold without product subdivisions.

The Society, largely because of Ross Purdy's constant efforts in that direction, has largely broken down the barriers of secrecy that kept the ceramic industry in the "dark ages" so long. By means of Product Divisions, and lately aided by summer meetings of those Divisions, men in the various branches have become well acquainted and knowledge has been pooled for the benefit of all. In my judgment we are not yet ready to discard the Divisions.

Our tendency is in that direction. In the future we will no doubt devote more of our Annual Meetings to general sessions. The officers are constantly studying these problems, as can be seen by reading the Presidential Addresses for the last ten or more years. The Materials and Equipment Division no doubt will receive the next concentrated study. We are gradually moving in the direction of Major's recommendation. I hope his letter will stir up a lot of discussion. It will be healthy and helpful.

FELLOWS

COOPERATION WITH AMERICAN FOUNDRYMEN'S ASSOCIATION

This is one of a series of notes intended to acquaint the membership with the purpose and history of our cooperative relations with other technical and scientific societies. The information contained herein was furnished by L. C. Hewitt and by R. E. Kennedy, Secretary of the A.F.A.

—ROBERT B. SOSMAN, *Dean of the Fellows. The American Ceramic Society, Inc,*

The members of the American Foundrymen's Association come from all sections of the country and from all kinds of positions in foundries and in related industries. The majority, however, are in the superintendent and engineering groups, with technically trained men probably making up about one third of the membership. The organization at the present time has about 5800 members.

The only direct contact of The American Ceramic Society with the A.F.A. is through the Joint Committee on Foundry Refractories. This Committee was proposed at a meeting of The American Ceramic Society in Columbus, in February, 1925. At that time, some representatives of the American Foundrymen's Association attended the meeting and proposed that such a Joint Committee be formed. This met with favor and subsequently representatives of a number of technical organizations were invited to a meeting to discuss the formation of the Joint Committee. This first meeting was held on September 14, 1925, at which time the Committee in question was duly organized.

Societies and organizations now represented on the Committee are The American Ceramic Society, the American Foundrymen's Association, the American Refractories Institute, the Malleable Founders' Society, the American Society for Testing Materials, the Electrochemical Society, the National Bureau of Standards, the U. S. Department

of Commerce, Division of Simplified Practice, the Steel Founders' Society of America, and the American Institute of Mining and Metallurgical Engineers, Institute of Metals Division.

For a number of years L. C. Hewitt of the Lacledе-Christy Clay Products Co., St. Louis, Mo., has been appointed as representative of The American Ceramic Society on this Committee. The Committee itself has elected him chairman.

Under the sponsorship of the Committee, surveys on the use of refractories in the foundry industry have been published by the A.F.A. In addition, the Committee has sponsored the following Simplified Practice Recommendations by the U. S. Department of Commerce: Malleable Foundry Refractories (Simplified Practice Recommendation R79–28) and Cupola Refractories (Simplified Practice Recommendation R154–38).

The articles that have been published by the A.F.A. under the sponsorship of the Joint Committee on Foundry Refractories are as follows:

"Preliminary Reports of Subcommittee on Survey of Refractories in the Malleable, Steel, and Nonferrous Foundries" (1926).

"Refractories for Brass Foundry Furnaces" (1928).

"Practical Melting with Electric Arc Furnace in General Jobbing Brass Foundry, with Special Emphasis on Operation Maintenance and Cost" (1929).

"Report of Joint Committee on Refractories; Subcommittee Survey of Gray Iron Foundry Refractories" (1929).

"Refractory-Maintenance Cements in the Nonferrous Foundry" (1930).

"Foundry Refractories" (1931).

Another activity of the A.F.A. in which The American Ceramic Society might cooperate profitably to both societies would be in connection with Heinrich Ries' Research Committee on Foundry Sand. The sand work is a special feature of Association activities, and any American Ceramic Society connection would be directly through Dr. Ries' Committee.

INSTITUTE OF CERAMIC ENGINEERS

President: H. B. DuBois, Consolidated Feldspar Corp., Trenton, N. J.
Vice-President: R. F Sherwood, United Feldspar & Minerals Corp., New York, N. Y.
Secretary: Karl Schwartzwalder, A C Spark Plug Co., Flint, Mich.
Past-President: H. M. Kraner, Bethlehem Steel Co., Bethlehem, Pa.
Trustee Representative: H. G. Wolfram, Porcelain Enamel & Mfg. Co., Baltimore, Md.

COMMITTEE CHAIRMEN APPOINTED FOR 1943–1944

Committee on Membership and Examinations: A. S. Watts, Dept. of Ceramic Engineering, Ohio State University, Columbus, Ohio.
Committee on State Boards of Engineering Examiners: A. F. Greaves-Walker, Office of Production Research & Development, War Production Board, Washington, D. C.
Committee on Engineers Council for Professional Development: A. F. Greaves-Walker.
Committee on Rules: M. F. Beecher, Research Lab., Norton Co., Worcester, Mass.

CERAMIC ENGINEERS LICENSED IN WEST VIRGINIA

The State Registration Board of Professional Engineers of West Virginia recently notified the Institute of Ceramic Engineers that ceramic engineers would be recognized and licensed as such in that state.

The Institute, through its Committee on State Boards of Engineering Examiners, has been attempting for years past to obtain recognition, and the officers and members are particularly pleased with the results as West Virginia completes the list of states which are large producers of ceramic products in which ceramic engineers can now be licensed as professional engineers.

REPORT OF COMMITTEE ON CERAMIC EDUCATION

Postwar Ceramic Employment

The tremendous task of the postwar readjustment in the employment of ceramic engineers is realized. Upon the return of our members from the service, we should be in a position to expedite their return to ceramic positions. Added to these men there undoubtedly will be many who will be the victims of postwar plant realignment.

It is the recommendation of this Committee that a ceramic engineer pool be created. This pool can be drawn upon to supply the demand for such men. The Education Committee of the Institute has compiled valuable information relative to the requisites of our several ceramic industries (see *Bull. Amer. Ceram. Soc.*, **18** [7] 248–49 (1939) and **19** [6] 230–32 (1940)). With tabulated data regarding the status and experience of each member of the pool, the Education Committee or other duly appointed group of the Institute would be in an excellent position to act as an intermediary between the employers of ceramic engineers and those unemployed at the time.

To function properly, this Committee should have the cooperation not only of the returning ex-service men and others out of employment but the several ceramic colleges and the industrial and technical employers of ceramic engineers. It would seem advisable that the first active step would be to let it be known that such an organization is to be created. The second step would be to make a list, as complete as possible, of those who are temporarily out of ceramic work. These men should be contacted to determine their employment status upon return to postwar life. The third step would be to ask the ceramic colleges to cooperate, to do all in their power to help in the readjustment of these men in any way possible. The fourth step would be to inform the Corporation Members of The American Ceramic Society, and all other employers of industrial and technical ceramic men, of the pool and of the information at the disposal of the Institute Committee. These prospective employers should be invited to draw upon this pool for their immediate needs.

The colleges can play a large part in this period of adjustment. Refresher courses could be offered to draw the younger graduates back into the field of ceramics and to bring them up-to-date in ceramic technology. It also would provide that element of time so important in keeping the engineer occupied in the right manner during this trying period.

It is further recommended that an explanatory letter together with a short questionnaire be sent to each of the following three groups: (1) the present men in service or at the moment out of ceramic work; (2) the industrial and the technical employers of ceramic engineers; and (3) the ceramic colleges.

The existence and the function of this Committee should be given monthly space in *The Bulletin of The American Ceramic Society* and in the various technical and trade magazines as long as the emergency lasts

The Education Committee wishes also to go on record as advising the Institute to keep and maintain a yearly check upon the status of all members of the Institute.

—R. K. Hursh, James R. Beam, Grant S. Diamond, and R. M. Campbell, *Chairman*

(1943)

REPORT OF COMMITTEE ON PROFESSIONAL STATUS

The apparent reason for the existence of this Committee is that it may examine the professional status of ceramic engineers and attempt to make constructive suggestions for its improvement. But first let us define it. Our professional status is briefly what the public thinks of us—not what we might wish them to think nor even what we really are, but *what the public thinks*. We have a professional status only insofar as the public regards us as members of a group which practices a learned and difficult vocation in the performance of work which is important in the public interest.

And what then do we find when we examine this question objectively? Frankly, the answer is not flattering. Most of the public does not know we exist. A lot more do not know how to define the word "ceramic." We have constant appeals for help in convincing the draft boards that we are really engineers at all or that, if so, our work is really an essential occupation.

Obviously one of the things we need is a cracking good press agent. We all need to become press agents. Some other things, however, are wrong.

First, how about licensing? Our Committee on licensing has done an excellent job. We are eligible for licensing almost anywhere that any other kind of an engineer is. But how many of us have ever sought to qualify for that stamp of public recognition? Very few.

I am particularly concerned with the status of our educators in this licensing matter. Can you imagine a medical school without one licensed M.D. on the faculty? Certainly not! Can you imagine a law school where no professor had ever been admitted to the bar? Ridiculous! And how about a College of Ceramics? Ah, a College of Ceramics! That is different. You apparently do not have to be a ceramic engineer or even any other kind of engineer to teach ceramic engineering. The mere fact that the law forbids setting yourself up as an engineer or practicing engineering without a license makes no difference.

I know of at least one such school (which I fear is no exception) in a state where graduate ceramic engineers from that school are eligible for licenses, in which the most recent published list of engineers licensed to practice in that state does not contain the name of one single member of the faculty who teach the ceramic engineers how to qualify for a license. Such a law is a travesty and such a situation is a disgrace to our profession.

We should take licensing seriously as a tool in building up our professional status. Not only should an unlicensed man be prohibited by law from teaching ceramic engineering, but the faculties of our colleges of ceramic engineering should urge upon their students the fact that they should strive for the early procurement of licenses and not stop until they have attained them.

Our lackadaisical attitude causes the authorities to discount and look down on us. We are regarded as some sort of a substandard bastard engineer who does not really count. For example, I received a letter this month from Irwin A. Conroe, Assistant Commissioner for Professional Education in my home state of New York. He writes as follows:

"I believe you are quite right in saying that undoubtedly ceramic engineers are eligible for licensure as professional engineers. You are also right in your statement that no examination has ever been drawn up for them to enable them so to qualify. The reason for this latter is comparatively simple. . . . The number of ceramic enginers coming annually into the profession are relatively few in comparison with the numbers going into civil, mechanical, or electrical engineering. Furthermore, ceramic engineering is in reality a specialized field of engineering. Therefore (italics are mine) *rarely would ceramic engineers be found who had completed the broad basic training and acquired the broad basic knowledge necessary for admission. . . .*"

When the educational experts regard us that way, how can we wonder that the Selective Service officials look down upon us the way that they seem to?

Another step I would urge in improving our professional status would be to associate ourselves professionally with other engineers for common objectives. Our whole Institute numbers only two or three hundred men. We need more members in it, but in the meantime there are helping hands outside if our individual members wish to grasp them. Again, however, licensing plays a part. Any licensed engineer is eligible for membership in such organizations as the American Association of Engineers or the National Society of Professional Engineers, which are militant organizations devoted to the upholding of any cause that concerns the welfare of their members.

The New York branch of the National Society of Professional Engineers, to which I happen to belong, maintains a paid observer at the state capital to analyze and report to local sections throughout the state upon every bill which comes before the legislature which in any way affects any engineer. It costs money, of course, but if you really take your engineering seriously, other engineers may feel more like taking you seriously—and the combined groups work on the "one for all and all for one" principle with more strength in a couple of counties than our Institute can muster in the whole country.

Finally, let us have more of our members active in civic affairs. A little demonstrated imagination and action go a long way in establishing professional status. I should like to think that when someone asked concerning one of us, "Who is this John Jones?" the answer would not be "Oh, he's that guy with a red-haired wife down on Fifth St." but rather "Why, you surely know him. He's that ceramic engineer at the Blank Company. You can count on him!" If all of our members had that reputation, we would not need to worry about professional status. We would *have* it.

—G. J. EASTER, *Chairman*

REPORT OF COMMITTEE ON NATIONAL COUNCIL OF STATE BOARDS OF ENGINEERING EXAMINERS

This Committee has little to report this year. On account of the war no meeting of the Council was held last fall.

The only state that is a large producer of ceramic products which has not yet provided for the licensing of ceramic engineers is West Virginia. The situation in that state has not changed. The State Board will take favorable action only when ceramic engineers living in West Virginia demand recognition.* Although the West Virginia members of the Institute may not be personally interested in securing licenses, they would be forwarding the program of the Institute for professional recognition by doing so.

The Institute has come a long way on the road to professional recognition of ceramic engineers since it started its program, but the work has been done by a limited number of members. If we are to attain our objectives, every member must give all assistance possible and the Committee is again appealing to West Virginia members to do their share.

Ceramic engineers are now licensed in the following states: Alabama, Arizona, Colorado, Connecticut, Delaware, Florida, Georgia, Indiana, Iowa, Kentucky, Maryland, Michigan, Missouri, Nebraska, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, Wisconsin, and Illinois.

The licensing law in Illinois goes into effect this year. As the Committee understands the Illinois law is based on the Model Law, any ceramic engineer who has had sufficient experience can secure a license under the "Grandfather" clause within a limited period. Ceramic engineers in Illinois are advised to take advantage of this immediately.

—A. F. GREAVES-WALKER, *Chairman*

*West Virginia has since recognized ceramic engineers, as reported on p. 249 of this issue of *The Bulletin*.—EDITOR

REPORT OF COMMITTEE ON ENGINEERS COUNCIL FOR PROFESSIONAL DEVELOPMENT

Last October, the chairman of the Committee met with the Council as a member for the first time. The ceramic engineers have the American Institute of Mining and Metallurgical Engineers to thank for this representation.

During the period in which the ceramic engineers had no direct representation, the Committee maintained close contact with the Council, and in the majority of inspections of ceramic engineering departments the inspection committees contained a ceramic engineer or a mining engineer friendly to our group.

During the past year, the department at the Georgia School of Technology was fully accredited, the chairman of your Committee and the Dean of Engineering of the University of Tennessee making the inspection and recommendation. This action completes the accrediting of all eligible departments of ceramic engineering or ceramics. Our branch of engineering thus becomes the first to reach the one hundred per cent mark, although all the departments are not classified as "fully accredited."

This goal was not reached without a great deal of work and would not have been reached at this time had the Institute not been organized at the psychological moment.

Although we have now attained this desirable objective, the Institute cannot afford "to rest on its oars." To retain the accredited status, departments must maintain certain standards or they will be dropped from that classification. Should the war last as long as the best thought in Washington and London anticipates, the departments of ceramic engineering will have practically passed out of existence. Student bodies will have to be rebuilt "from scratch" and, in some cases, at least, faculty vacancies will have to be filled. During this period, close contact with the Engineers Council for Professional Development undoubtedly will be necessary.

During the war, the Council will make no reinspections nor make changes in present status.

As the E.C.P.D. is made up of representatives of the four Founders Societies—the American Institute of Chemical Engineers, the National Council of State Boards, the Society for the Promotion of Engineering Education, and the Institute of Engineers of Canada—it would seem advisable that the Institute maintain close contacts with these organizations until such time as it is admitted to the Council. —A. F. GREAVES-WALKER, *Chairman*

RULES OF THE INSTITUTE OF CERAMIC ENGINEERS

(Effective April 21, 1943)

Article EIR I. Name

(1) The official title of this Class shall be THE INSTITUTE OF CERAMIC ENGINEERS, an affiliate of THE AMERICAN CERAMIC SOCIETY, INC.

Article EIR II. Purpose

(1) It shall be the purpose of this INSTITUTE (*a*) to promote the professional status of ceramic and other engineers engaged in all branches of the ceramic industry and to promote their general welfare; (*b*) to promote and improve ceramic engineering education; (*c*) to promote the professional development of young engineers in the ceramic industry after graduation.

(2) THIS INSTITUTE shall represent THE SOCIETY in all matters pertaining to ceramic engineers and ceramic engineering as authorized by the Board of Trustees.

Article EIR III. Membership

(1) THE INSTITUTE shall consist of those Fellows, Members, and Life Members of these grades of THE AMERICAN CERAMIC SOCIETY in good standing who have been approved and recommended by the Committee on Membership and Examinations of THE INSTITUTE and admitted to membership by the Executive Committee of THE INSTITUTE.

(2) (*a*) THIS INSTITUTE shall have the three following grades of membership: Member, Associate Member, and Junior Member.

(*b*) Membership cards designating the grade of membership held in THE INSTITUTE shall be issued annually by the offices of THE AMERICAN CERAMIC SOCIETY to each member in good standing, and once each year the classified membership roster of THE INSTITUTE shall be published in *The Bulletin of The American Ceramic Society*.

(3) Membership in THE AMERICAN CERAMIC SOCIETY is a continuing requirement for all grades of membership in THE INSTITUTE OF CERAMIC ENGINEERS.

(4) Applicants for Member and Associate Member grade shall have been members of THE AMERICAN CERAMIC SOCIETY for at least five years immediately preceding date of application.

(5) Only those of Member and Associate Member grades shall be entitled to vote.

(6) Only those of Member grade shall be entitled to hold elective office in THE INSTITUTE.

(7) Members admitted previous to the adoption of these Rules shall retain the grades already attained, but promotions shall, in the future, be governed exclusively by these revised Rules.

(8) (*a*) The practice of Ceramic Engineering subsequently referred to shall be construed to include administration, engineering design, production, technical production control, major supervision, teaching, research, or important investigation in the field of Ceramic Engineering. To determine whether the years of practice of Ceramic Engineering of any applicant have resulted in the attainment of the requisite qualifications, the Membership and Examinations Committee may, in its sole discretion, require the passing of such oral and written examinations as it may deem necessary.

(*b*) The term, "responsible technical charge" hereinafter used, shall be construed to connote a technical capacity to conceive, design, and execute Ceramic Engineering work.

(9) In determining the applicant's qualifications for admission to or for elevation in grade in THE INSTITUTE, three years' credit may be allowed, both in the age requirement and in the number of years of practice in Ceramic Engineering, for the possession of a Professional Engineer's License granted by a State or Federal Board of Engineering Examiners, but when so accredited, the possession of such license shall in no other respect abrogate or serve as a substitute for any other requirement for any grade of membership.

(10) MEMBER: The grade of Member may be held by those comprising the Founders Group of THE INSTITUTE.

(11) (*a*) MEMBER: The grade of Member may be granted to applicants who are at least thirty-five years of age, who have graduated with a degree in Ceramic Engineering from a school or college having a curriculum in Ceramic Engineering accredited by the Engineers Council for Professional Development, and who have, in addition, a specific record of twelve years or more of continuous active practice in Ceramic Engineering, of which five years at least must have been in responsible technical charge of important Ceramic Engineering work.

(*b*) MEMBER: The grade of Member may be granted also in certain exceptional cases to applicants who hold an Engineering degree granted upon completion of a curriculum accredited by the Engineers Council for Professional Development, who are at least thirty-five years of age, and who have, in addition, a specific record of fifteen years or more of continuous active practice in Ceramic Engineering, of which five years at least must have been in respons-

ible technical charge of important Ceramic Engineering work.

(12) ASSOCIATE MEMBER: The grade of Associate Member may be granted to applicants at least thirty years of age who hold a degree in Ceramic Engineering from a school or college having a Ceramic Engineering curriculum accredited by the Engineers Council for Professional Development and who, in addition, at the time of application, are and have been in continuous active practice in important Ceramic Engineering work for seven years or more.

(13) JUNIOR MEMBER: The grade of Junior Member may be granted to applicants who are at least twenty-one years of age and who are qualified for subprofessional work in Ceramic Engineering by reason of being graduated in Ceramic Engineering from a school or college in which that department is accredited by the Engineers Council for Professional Development. Junior membership shall terminate at the end of ten years if the holder has not qualified for and been advanced to a higher grade before that time.

(14) ELEVATION IN MEMBERSHIP: (*a*) Associate Members, upon application, may be promoted to Member grade when they shall have attained the qualifications of and fulfilled all of the requirements for the Member grade as stipulated in Article EIR III, Section 11 (*a*) or 11 (*b*).

(*b*) Junior Members, upon application, may be promoted to Associate Member grade when they shall have attained the qualifications of and have fulfilled all of the requirements for Associate grade as stipulated in Article EIR III, Section 12.

(15) All other Articles, Sections, or paragraphs of the Rules of THE INSTITUTE or the Rules of the Executive Committee, inconsistent with the foregoing revisions of Article EIR III, Sections 1 to 14, inclusive, are hereby revoked.

Article EIR IV. Government

(1) The officers of THE INSTITUTE shall be a President, Vice-President, and Secretary-Treasurer. These officers, together with the Trustee representing THE INSTITUTE and the most recent Past-President, shall constitute the Executive Committee of THE INSTITUTE.

(2) The term of office of President, Vice-President, and Secretary-Treasurer shall be one year, to wit: from the close of one Annual Meeting of THE SOCIETY to the close of the next succeeding Annual Meeting, or until their respective successors have been elected and duly qualified. The term of office of the Trustee representative of THIS INSTITUTE shall be three years, to wit: from the close of one Annual Meeting of THE SOCIETY to the close of the third succeeding Annual Meeting, or until his successor shall have been elected and duly qualified.

(3) In the interval between the Annual Meetings of THE INSTITUTE, all executive powers of THE INSTITUTE shall be vested in the Executive Committee.

(4) It shall be the duty of the Executive Committee to consider carefully all recommendations of the Committee on Membership and Examinations and to elect or advance all members who, in their estimation, are qualified. It shall require a four-fifths affirmative vote of the Executive Committee to elect or advance a member in grade.

(5) The decisions of the Executive Committee shall be final on all questions involving the interpretation of the Rules of THE INSTITUTE, except questions of conflict with the Constitution, By-Laws, and Rules of THE SOCIETY which are finally decided by the Board of Trustees.

(6) The Executive Committee may, with the approval of the Board of Trustees of THE SOCIETY, make an assessment on the entire membership of THE INSTITUTE which shall not exceed two dollars ($2.00) per annum, when such assessment is necessary to meet financial obligations exceeding the amount appropriated to THE INSTITUTE by THE SOCIETY.

(7) Any member failing to pay an assessment within one year of the date of first notification may be suspended by the Executive Committee until such assessment is paid, and the Executive Committee may drop any member from the membership list whose assessment is in arrears more than one year and six months.

Article EIR V. Meetings

(1) The annual business meeting of THE INSTITUTE shall be held during the week of the Annual Meeting of THE SOCIETY.

(2) Twenty-five voting members of THE INSTITUTE shall constitute a quorum at the annual business meeting or any special business meeting.

(3) Papers concerned only with the subjects listed under purposes of THE INSTITUTE (Article EIR II) may be presented at the annual business meeting of THE INSTITUTE.

Article EIR VI. Officers

(1) The President shall have general supervision of the affairs of THE INSTITUTE. He shall preside at all meetings of THE INSTITUTE and the Executive Committee. He shall appoint all standing and special committees, unless otherwise specified in these Rules.

(2) The Vice-President shall assist the President and shall succeed to the powers and duties of the President in the event of the refusal or incapacity of the President to act.

(3) The Secretary-Treasurer shall keep minutes of all INSTITUTE and Executive Committee meetings and a full record of the correspondence of the INSTITUTE. With the President, he shall duly authorize all payments from the funds of THE INSTITUTE. He shall perform such other duties as the President may properly assign to him.

(4) Seven (7) Assistant Secretaries shall be appointed by the President, with the approval of the Executive Committee, to serve for a term of one (1) year. They shall act as regional contact officers in the seven regions hereinafter defined. It shall be the duty of these officers to maintain contact with the State Boards of Engineering Examiners in their respective regions and to cooperate with them in all matters of interest to ceramic engineers.

The seven (7) regions shall be defined as follows:

The Northeast Region shall include the following states, viz., Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, New Jersey, Maryland, Delaware, and the District of Columbia.

The Central Region shall include the following states, viz., West Virginia, Ohio, Indiana, Kentucky, Illinois, Wisconsin, and Michigan.

The Southern Region shall include the following states, viz., Virginia, North Carolina, South Carolina, Tennessee, Georgia, Florida, Alabama, and Mississippi.

The West Central Region shall include the following states, viz., Minnesota, North Dakota, South Dakota, Iowa, Nebraska, Kansas, and Missouri.

The Southwest Region shall include the following states, viz., Arkansas, Louisiana, Oklahoma, Texas, New Mexico, and Arizona.

The Intermountain Region shall include the following states, viz., Montana, Idaho, Wyoming, Utah, and Colorado.

The Western Region shall include the following states, viz., Washington, Oregon, Nevada, and California.

Article EIR VII. Nominations and Elections

(1) The voting members of THE INSTITUTE in meeting assembled shall elect, by secret ballot, an Executive Nominating Committee of five (5) voting members which shall nominate one (1) candidate for the office of President and two (2) candidates for each of the offices of Vice-President and Secretary-Treasurer.

(2) Any group of fifteen (15) voting members of THE INSTITUTE may constitute themselves a nominating committee by forwarding to the President of THE INSTITUTE the names of their nominee or nominees over their signatures, at least eighty (80) days prior to the Annual Meeting of THE SOCIETY.

(3) The Executive Nominating Committee shall submit to the President of THE INSTITUTE a list of candidates together with their acceptances at least ninety (90) days prior to the Annual Meeting of THE SOCIETY.

The President of THE INSTITUTE shall transmit the nominations to the General Secretary of THE SOCIETY who shall submit ballots by mail to the voting members of THE INSTITUTE at least sixty (60) days prior to said Annual Meeting of THE SOCIETY. The ballots shall bear the names of the nominees and the closing date of the voting.

The ballots shall be returned to the President of THE INSTITUTE in a plain envelope marked only with the words "Institute Ballot." This envelope shall be enclosed in another envelope for mailing upon the back of which the voter shall endorse his name. Only those ballots so returned thirty (30) days before the opening date of the said Annual Meeting shall be counted.

The President of THE INSTITUTE shall have the ballots counted immediately after the close of the voting and shall transmit the results of the election to the General Secretary.

(4) The Executive Nominating Committee shall nominate one or more candidates for Trustee representative of THE INSTITUTE prior to the Annual Meeting of THE SOCIETY at which the triennial term of the Trustee representative of THE INSTITUTE expires and forward his or their names together with his or their acceptances in writing to the President of THE INSTITUTE at least ninety (90) days prior to said Annual Meeting.

The President of THE INSTITUTE shall transmit the nomination or nominations to the General Secretary of THE SOCIETY for inclusion in the ballot of THE INSTITUTE as provided in Section (3) hereof.

(5) (*a*) In the event of the refusal to act, or incapacity to act, of the Trustee representative of THE INSTITUTE, a successor to fill the unexpired term shall be elected prior to the next succeeding Annual Meeting of THE SOCIETY as provided in Section (4) hereof.

(*b*) Any vacancy occurring in the offices of THE INSTITUTE between Annual Meetings, other than that of the Trustee representative, shall be filled by interim appointment of the President.

Article EIR VIII. Relations with The Society

(1) As soon as possible after each Annual Meeting of THE SOCIETY the President of THE INSTITUTE shall fill all vacancies on the Standing Committees of THE SOCIETY as currently required by the By-Laws.

(2) The President of THE INSTITUTE shall promptly appoint Institute representatives to special committees of THE SOCIETY upon notification from the President of THE SOCIETY.

(3) THE INSTITUTE shall not expend funds of THE SOCIETY or incur indebtedness without the formal approval of the Board of Trustees.

(4) The provisions of the Constitution, By-Laws, and Rules of THE SOCIETY shall govern the procedure of THIS INSTITUTE, but no action or obligation of THIS INSTITUTE shall be considered an action or obligation of THE SOCIETY.

(5) The Executive Committee of THE INSTITUTE shall submit to the Board of Trustees of THE SOCIETY, at least ninety (90) days before each Annual Meeting, a budget of estimated expenditures for the ensuing year.

Article EIR IX. Insignia

(1) The insignia of THE INSTITUTE shall be the official seal of THE SOCIETY superimposed on a gear so that the rim of the gear and the surrounding teeth form the frame. On the rim of the gear shall be embossed the inscription, "THE INSTITUTE OF CERAMIC ENGINEERS."

Article EIR XII. Committees

(1) The Standing Committees of THE INSTITUTE shall be as follows:

(*a*) Rules
(*b*) Engineers Council for Professional Development
(*c*) Membership and Examinations
(*d*) State Boards of Engineering Examiners
(*e*) Education
(*f*) Professional Status and Development

(2) The Committee on Rules shall consist of three (3) members appointed by the President to serve for the term of one year. The Chairman of the Committee shall be THE INSTITUTE representative on the Committee on Rules of THE SOCIETY.

It shall perform such duties as required by the Executive Committee of THE INSTITUTE relating to interpretation or amendments of the Rules of THE INSTITUTE.

(3) The Committee to cooperate with the Engineers Council for Professional Development shall consist of three (3) members appointed by the President to serve for a term of three (3) years each. The senior member of the Committee shall act as Chairman.

It shall be the duty of this Committee to cooperate with the Engineers Council for Professional Development in matters affecting ceramic engineers and ceramic engineering.

(NOTE: In order to obtain the proper rotation of appointments, the President shall name on the first committee three members to serve for one, two, and three years, respectively.)

(4) The Committee on Membership and Examinations shall consist of five (5) members appointed by the President to serve for terms of five (5) years each. The Chairman of the Committee shall be appointed by the President and shall be THE INSTITUTE'S representative on the Committee on Membership of THE SOCIETY. At least one member of the Committee shall be a member of the faculty of a department of ceramic engineering.

It shall be the duty of the Committee to receive and evaluate all applications for membership and advancement in grade of membership in THE INSTITUTE. The Committee shall prepare and supervise, either personally or by proxy, the examination, whenever necessary, of all those making application to qualify for the grade of Member, and make recommendations to the Executive Committee of THE INSTITUTE.

It shall be the duty of the Committee to prepare, and revise as becomes necessary, a list of departments of ceramic engineering, the graduates of which will be considered as meeting membership requirements under Article EIR III. This list must be approved by the Executive Committee of THE INSTITUTE before becoming official.

(NOTE: In order to obtain the proper rotation of appointments, the President shall name on the first Committee five (5) members to serve for one, two, three, four, and five years, respectively.)

(5) The Committee on State Boards of Engineering Examiners shall consist of the seven (7) Assistant Secretaries, from among which the President shall appoint the Chairman of the Committee.

It shall be the duty of this Committee to maintain contact with all State Boards of Engineering Examiners and to protect and further the interest of ceramic engineers in all matters pertaining to state board examinations and licensing.

(6) The Committee on Ceramic Engineering Education shall consist of five (5) members, two of whom shall be members of the faculties of departments of ceramic engineering, to be appointed by the President to serve for terms of five years each. The Chairman of the Committee shall be appointed by the President to serve for a term of five (5) years and shall be THE INSTITUTE'S representative on the Committee on Ceramic Education of THE SOCIETY.

It shall be the duty of this Committee to cooperate with departments of ceramic engineering and the Ceramic Educational Council in an effort to improve constantly the training of students in the departments of ceramic engineering in order that they may better meet the requirements of industry and the State Boards of Engineering Examiners.

(NOTE: In order to obtain the proper rotation of appointments, the President shall name on the first committee five (5) members to serve for one, two, three, four, and five years, respectively. The first Chairman shall be appointed to serve until 1942.)

(7) The Committee on Professional Status and Development shall consist of three (3) members to be appointed by

the President to serve for the term of one year. Its duties shall be to seek means of improving the professional status of ceramic engineers through publicity and contact with other organizations of engineers, to develop means for encouraging a desirable type of high-school student to enter the departments of ceramic engineering through the publication of articles, booklets, etc., and to develop a program of development for young ceramic engineering graduates.

(8) The President may, from time to time, appoint such special committees and delegate to them such powers as he may deem proper, subject, however, to the Constitution, By-Laws, and Rules of THE SOCIETY and the Rules of THE INSTITUTE.

Article EIR XV. Amendments

(1) The Rules of THE INSTITUTE may be amended by giving written notice of the proposed amendments to the voting membership at least thirty (30) days before an Annual Meeting at which time the proposed amendments shall be presented and voted on. An affirmative majority vote of the voting members present shall be required to amend the Rules. Amendments may be initiated by five (5) voting members. Such amendments must be submitted in writing over their signatures to the President of THE INSTITUTE at least ninety (90) days before the Annual Meeting.

MEMBERS IN SERVICE*

The following members of this Society are in fighting units of war service. There are several in service in Washington not included in this Service Roster. This list, which was begun September, 1942, and added to each succeeding month, is probably not complete, and we would appreciate information on other members.

(174) GROVER COLE, College of Architecture and Design, University of Michigan, Ann Arbor, Mich.
(175) HENRY R. GARDEN, JR., Old Virginia Brick Co., Salem, Va.
(176) BERNHARD F. GENTSCH, United Clay Mines Corp., Trenton, N. J.
(177) C. A. LAMBELET, Missouri School of Mines, Rolla, Mo.
(178) ALBERT D. LORING, Johns-Manville Research Labs., Cincinnati, Ohio
(179) LANE MITCHELL, Georgia School of Technology, Atlanta, Ga.
(180) SIMEON NASH, JR., 156 South 17th St., Columbus, Ohio

* These are in addition to the lists published monthly, beginning with the September, 1942, *Bulletin*, with the exception of the June, 1943, issue.

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OUR STAKE IN THE PEACE

"Ignorance, rather than perversity and greed, is still man's costliest enemy, and research, in the long run, is still man's most profitable investment."

—From an address by William E. Wickenden, President, Case School of Applied Science

DEFINITION OF CERAMICS

The word *"Ceramic"* is a transliteration from the Greek adjective *"Keramikos,"* which is derived from *"Keramos,"* meaning *"fired stuff."**

There is an older Sanskrit root of *"Keramos"* meaning *"to fire."*

"Ceramic," derived from the Greek and Sanskrit *"Keramos,"* is the manufacture of products by the action of heat on materials of an earthy or nonmetallic nature in which the oxide of silicon and the compounds thereof (the silicates) predominate.

There was a glass medallion made in early imperial times by the artist who called himself *"A Kerameus."* This is evidence that even in antiquity ceramists were not only those who made art pottery from clay.

For nearly half a century, at Ohio State University, there has been a Ceramic Department devoted to the science and technology of the production of ware from clay, glass, and enamels.

For forty-five years, THE AMERICAN CERAMIC SOCIETY has been maintained by scientists, technologists, and engineers engaged in the clay, glass, and enamel industries.

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* See *Jour. Amer. Ceram. Soc.*, **3** [7] 537 (1920) and **11** [6] 335 (1928).

PAID MEMBERSHIP AND SUBSCRIPTION RECORD

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NEW MEMBERS IN JUNE

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CHISHOLM, BOYD AND WHITE CO., L. W. Flood (voter), 57th and Wallace Sts., Chicago, Ill.

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MATHIESON ALKALI WORKS, INC., R. E. Gage (voter), 60 East 42nd St., New York, N. Y.

Personal

BAKER, ARVID H., 25 Pine St., Port Allegany, Pa.; laboratory director, Pittsburgh Corning Corp.

BRUCE, CHARLES F., 413 Center Ave., Verona, Pa.; supervisor of physical tests, Harbison-Walker Refractories Co.

ISENHOUR, CHARLES W., JR., 2064 East 88th St., Cleveland, Ohio; laboratory assistant, Allied Engineering Co.

JONES, MAYNARD J., 267 Colwick Rd., Rochester, N. Y.; ceramic engineer, Pfaudler Co.

MESSIMER, LAVERNE A., 6007 Welborn Dr., Washington 16, D. C.; associate technologist, National Bureau of Standards.

NORWOOD, GEORGE M., Box 275, Lillington, N. C.; president, Rickman Brick Co.

STAFFICKER, CHARLES F., 8th Street and Park Ave., Vineland, N. J.; chemical engineer, Kimble Glass Co.

STEELE, H. D., Shorter & Son, Ltd., Copeland St., Stoke-on-Trent, England.

ZAHNISER, GEORGE B., 109 Englewood Ave., New Castle, Pa.; vice-president, Shenango Pottery Co.

Student

New York State College of Ceramics: GERALD F. RYNDERS.

Rutgers University: WILLIAM A. MILLER AND MALCOLM A. SCHWEIKER, JR.

MEMBERSHIP WORKERS' RECORD

Corporation

C. E. Bales	2	W. R. Lester	1
	Office	1	

Personal

C. E. Bales	7	D. A. Moulton	1
	Office	1	

Student

R. M. Campbell	1	E. P. McNamara	2
		Grand Total	**16**

ROSTER CHANGES FOR JUNE*

ALBERY, D. F., 431 Sherman Ave., Evanston, Ill. (Canton, Ohio)

BLAKE, EDWIN M., Box 210, Mt. Kisco, New York (Brooklyn, N. Y.)

BROWN, DAVIS, W. A. Riddell Corp., Bucyrus, Ohio (Los Angeles, Calif.)

CATON, ALBERT J., JR., 227 Clay St., Reno, Nevada (Boulder City, Nevada)

CLARK, HORACE N., Refractory & Insulation Corp., Port Kennedy, Pa. (New York, N. Y.)

CORBMAN, MORRISS, University Club, Bethlehem, Pa. (Thomasville, N. C.)

Dougan, CHARLES W., c/o P. A. Pedersen, R. F. D. 2, Hamilton, Mont. (Rolla, Mo.)

FAY, M. A., 915 E St., Sparrows Point, Md. (Bethlehem, Pa.)

HALLER, P., 106 High Storrs Rd., Sheffield 11, England (Yorkshire, England)

JOHNSON, ARNOLD, 224 E. Broadway, Maumee, Ohio (Toledo, Ohio)

KEITH, WENDELL P., Metallurgical Lab., University of Chicago, Chicago, Ill. (Seattle, Wash.)

MITCHELL, LT. (j.g.) LANE, USNR, NTS (I) 33039, Fort Schuyler, Bronx, N. Y. (Atlanta, Ga.)

MOHR, JOHN G., 110 East 3rd St., Corning, N. Y. (Alfred, N. Y.)

NOYES, BRADFORD, Faichney Instrument Corp., Watertown, N. Y. (Rochester, N. Y.)

PACKMAN, WILLARD D., Box 483, Latrobe, Pa. (Derry, Pa.)

REA, ROBERT F., Universal Zonolite Insulation Co., 2601 West 107th St., Chicago, Ill. (Denver, Colo.)

RIEGGER, HAROLD E., C.P.S. Unit 84, New Hampshire State Hospital, Concord, N. H. (Coleville, Calif.)

ROSALES, ANTONIO H., Palma Norti 308, Mexico, D. F. Mexico (formerly in name of Adolfo Görz)

ROSS, DONALD W., 609 Chenango St., Binghamton 5, N. Y. (Hyattsville, Md.)

SCHLEHR, W. RAYMOND, Demuth Glass Works, Inc., Parkersburg Div., Box 629, Parkersburg, W. Va. (Baltimore, Md.)

WRIGHT, ANN T., 121 Clifton Ave., Minneapolis, Minn. (Boston, Mass.)

* Address in parentheses is former address.

PERSONAL NOTES

R. R. RIDGWAY RECEIVES SCHOELLKOPF MEDAL

Raymond R. Ridgway, Associate Director of Research for Norton Company, Worcester, Mass., was awarded the Jacob F. Schoellkopf Medal for 1943 at the meeting of the Western New York Section of the American Chemical Society held at Niagara Falls, N. Y., May 20, 1943. Mr. Ridgway, who has his headquarters at the Chippawa,

Raymond R. Ridgway

Ontario, plant of Norton Company, is the thirteenth recipient of the Schoellkopf Medal, which is awarded annually by the Western New York Section.

Mr. Ridgway has been with Norton Company since 1922 and is recognized as one of the outstanding research men in electrochemistry. His record of the past twenty-five years covers a long list of inventions in the design of electric resistor-type furnaces; improvements in the production of fused alumina, silicon carbide, and magnesia; and the production of hard metal carbides. His outstanding accomplishment has been the isolation and commercial production of boron carbide, the hardest known material next to the diamond. Boron carbide is used extensively in abrasive form as a substitute for diamond dust in drilling and lapping carbide dies and tools. It is also made in molded form and because of its exceptional resistance to wear is used in nozzles for sandblasting and in contact points for gauges and measuring instruments.

Mr. Ridgway was born in Morris, Ill., August 27, 1897. He attended Lake Forest University and was graduated in 1920 from the Massachusetts Institute of Technology with a degree in electrochemical engineering. He was employed for two years by the Aluminum Company of America, Massena, N. Y., before becoming associated with Norton Company in 1922.

In winning the Schoellkopf Medal, Mr. Ridgway joins such distinguished predecessors as Lawrence H. Flett, Arthur W. Burwell, W. H. Bradshaw, Charles F. Vaughn, Sterling Temple, James G. Marshall, Albert H. Hooker, F. Austin Lidbury, James C. Downs, Frank A. Hartman, W. Hale Charch, and Frank J. Tone.

ROBERT MORRELL CAMPELL

President, Ceramic Educational Council

Robert Morrell Campbell was born January 27, 1899, at Passaic, N. J., the son of John M. and May Northrop Campbell. He was graduated from Passaic High School in February, 1918, and received the degree of ceramic engineering from Alfred University, Alfred, N. Y., in 1923. In addition, he attended summer courses in ceramics and structures at the Massachusetts Institute of Technology, Cambridge, Mass., and the Rhode Island State College, Kingston, R. I., respectively.

During World War I, Professor Campbell served in the U.S.N.R.F. from May, 1918, to August, 1919, as a seaman signalman on the *U.S.S. Minnesota* and the transport *U.S.S. Rijndam.*

In the summers of 1920, 1921, and 1922, he was employed successively by Charles S. Shultz & Son at their Kingston, N. Y., and Little Ferry, N J., plants and at the Rochester Clay Products Co., Rochester, Pa. From June, 1923, to 1930, he was associated as ceramic engineer with the J. L. Mott Co., Inc., Trenton, N. J., and from 1926 to 1930, he served as superintendent of pottery for the same company. From 1930 to 1933, he was engaged as ceramic engineer for the Trenton Potteries Co., Trenton, N. J. He has been professor of ceramic technology since 1933 at the New York State College of Ceramics, Alfred, N. Y., where he teaches chiefly courses in whiteware and structural planning and design.

Professor Campbell is a Fellow of The American Ceramic Society and a member of the Institute of Ceramic Engineers, the Ceramic Educational Council, the Society for the Promotion of Engineering Education, Keramos, the American Legion, and Delta Sigma Phi fraternity.

DUTY TO SELF, FAMILY, AND MANKIND

My duty is to make myself most capable physically, mentally, financially, and spiritually—a rugged individual—that I may do the best possible teamwork with other ceramists.

(1943)

Robert Morrell Campbell

STEPHEN W. DERBYSHIRE

Stephen W. Derbyshire, ceramist, has been appointed to the technical staff of Battelle Memorial Institute, Columbus, Ohio, and assigned to its division of ceramic research.

Mr. Derbyshire, who holds a Bachelor of Science degree in ceramic engineering from the University of North Caro-

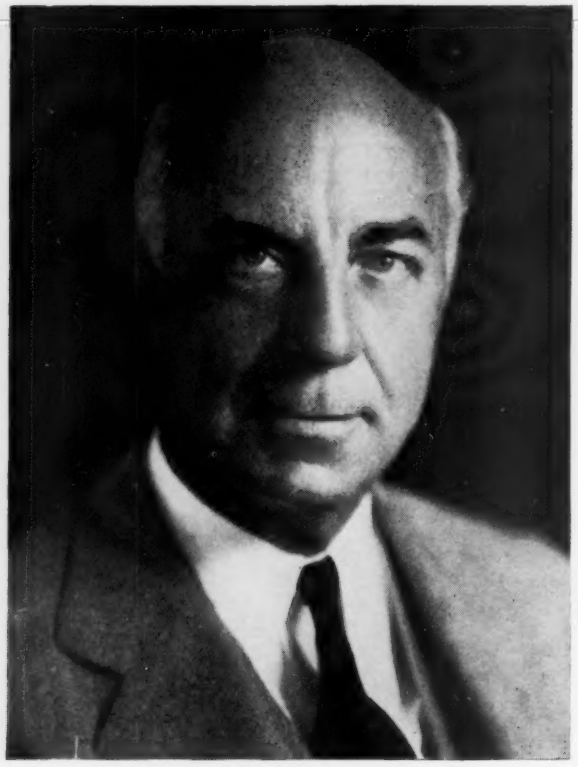
Stephen W. Derbyshire

lina, was formerly associated with the Mexico Refractories Company, Mexico, Mo. He is a member of The American Ceramic Society and Keramos.

NECROLOGY

FREDERICK KERSHAW

Frederick Kershaw, president of Proctor & Schwartz, Inc., Philadelphia, Pa., builders of industrial drying and textile machinery, died May 19, 1943, at his home following an illness of several weeks. He was fifty-eight years old.



Frederick Kershaw

Mr. Kershaw had been associated with Proctor & Schwartz since 1898. He left the company in 1907 to attend college but was called back to fill an important position before he was graduated.

JOHN D. BRUHN

John D. Bruhn, vice-president and general manager of the Sterling Borax Co., New Brighton, Pa., died suddenly of a heart attack May 23, 1943.

Born in Coudersport, Potter County, Pa., October 19, 1877, Mr. Bruhn was the son of the late John M. and Adelaide Strumpf Bruhn. Upon completing his education in the public schools of Potter County, he entered the baking industry and worked at his trade from 1891 to 1898 in various cities, including New York and Chicago. In 1898, he became affiliated with the Sterling Borax Company in the minor capacity of stoker. His rise began immediately and eventually he was made manager of the New Brighton plant and elevated to a vice-presidency.

In addition to his affiliation with the Sterling Borax Company, Mr. Bruhn was president of the McDanel Refractory Porcelain Company; chairman of the board of the Standard Horsenail Company; and vice-president and director of the Beaver Refrigerator & Potteries Company.

John D. Bruhn

Also active in community affairs, Mr. Bruhn had been serving as president of the Union National Bank; director of the Beaver County Federal Savings & Loan Association; treasurer of the Beaver County Manufacturers Association; member and treasurer of the New Brighton school board; president of the board of directors of the Beaver Valley General Hospital; and a director of the Beaver County Children's Home.

He was a member of the United Presbyterian Church and of several clubs, including the Rotary Club and the Brighton Club.

BENJAMIN DEPUE HARDESTY

"Ben" Hardesty, general manager of the Mayer China Co., Beaver Falls, Pa., passed away June 14, 1943.

MRS. FREDERICK CARDER

Word has been received of the death on May 3, 1943, of Mrs. Frederick Carder, wife of Frederick Carder, art director of the Corning Glass Works, Corning, N. Y. Mrs. Carder had been in poor health for a number of years and had recently suffered a heart attack. The former Miss Annie Walker, she was a native of Staffordshire, England. She and Dr. Carder were married in England and came to Corning to make their home in 1903.

Mrs. Carder was a member of Christ Church. Besides her husband, she is survived by a daughter, Mrs. Gillett Welles, of Hudson, Ohio; two grandsons, Lieutenantt Carder Welles, of New York, now in Iceland, and Gillet Welles, Jr., of Mt. Zoar Hill, Elmira, N. Y.; and two great-grandsons, Gillett Welles III and Peter Swift Welles, both of Elmira.

To Dr. Carder, who was ill in Corning Hospital, and to her daughter and grandchildren we extend our deepest sympathy.

ADOLFO GÖRZ

Word has been received of the death of Adolfo Görz in Mexico City, April 25, 1943. He was sixty-one years old.

Mr. Görz was born in Germany, where he became a practical potter and later took a technical course in ceramics. He went to Mexico thirty-five years ago and became prominently identified with the manufacture of pottery.

He had designed, built, and was for many years manager of El Anfora, the largest general ware plant in Mexico and located in Mexico City. More recently he had undertaken the construction and management of a new plant to be known as Fabrica de Loza la Favorita S. A. (Fabrica de Loza meaning general ware dishes).

The death of Mr. Görz is a loss to the pottery industry. He had traveled frequently in the United States and had made many friends among the members of The American Ceramic Society, of which Society he had a been member since 1935.

FRANK WILLOUGHBY BUTTERWORTH

Frank Willoughby Butterworth, chairman of the board of the Western Brick Co., Danville, Ill., died May 27, 1943.

Mr. Butterworth was born in Philadelphia, Pa., February 20, 1870, the son of Thomas J. and Annie C. (Melcher) Butterworth. He was graduated from Central High School in Philadelphia in 1886.

After graduation, Mr. Butterworth left Philadelphia for Chicago, where he was employed during 1886 and part of 1887 by Marshall Field; in 1887, he returned to Philadelphia and was employed by Murrell Dobbins. Late in 1887, he returned to the Middle West and the brick business, a business familar to him in his early youth, inasmuch as close relatives had been active in this industry in Philadelphia. He joined the Marion Brick Works in 1890 and from 1896 to 1899 served as its general manager, having been appointed to this position at the age of twenty-six.

In 1898, he married Blanche Ralston and to this union one child was born, Catherine R.

When the Western Brick Company was organized in 1900, he became its general manager and located and built the plant at Danville, Ill. During the years which followed, his business efforts were spent in developing this company into one of the largest and most successful clay products plants in the country. In 1933, he became its president and in 1939 was made chairman of the board.

During his long service in the clay industry, he had given much to its development. He was active in the American Face Brick Association for many years and for a long time served as its president. He was chairman of its Research Committee from 1925 to 1930, during which time much valuable research was conducted by the National Bureau of Standards, Washington, D. C., on the efflorescence–water penetration of walls and similar subjects.

During World War I, he was a member of the War Service Committee on Brick, District No. 10, and of the Illinois State Council of Defense. Under the NIRA, he served as a member of the Code Authority Committee and was chairman of the Joint Mid-Western Central Regional Committee for the Clay Products Industry.

At the time of his death, he was president of the Illinois Ceramic Institute. He had been a member of the Advisory Board of the Department of Ceramics at the University of Illinois since its inception, which honor was due him because he was energetic in securing legislative action at Springfield approving the organization of a ceramic engineering department at the university.

At home, Mr. Butterworth was a leader in many civic enterprises and aided and supported every worthy cause. He founded the first chapter of the American Red Cross in Vermilion County twenty-five years ago and had been serving as County Chairman at the time of his death.

Frank Willoughby Butterworth

Mr. Butterworth was a member of the Elks, the Masons, the Union League of Chicago, the Columbia Club of Indianapolis, and the Danville Country Club.

In 1941, he was elected to honorary membership in Keramos.

He had been a member of The American Ceramic Society since 1920.

A NEW HEAVEN—A NEW EARTH

Book of Revelation—River of water of life—Leaves of trees on the bank of which are for the healing of the nations.
Plato—"Timaeus" and "The Republic"
St. Augustine—"The City of God"
Sir Thomas More—"Utopia"
Francis Bacon—"The New Atlantis"
Campanella—"City of the Sun"
James Harrington—"Oceana"
The New Deal—"Freedom from Want and Fear"

Suggested by baccalaureate address of Chancellor W. P. Tolley, Syracuse University

NOTES FOR CERAMISTS

SHALL RESEARCH BE SOCIALIZED?*

The Kilgore Bill (S. 702) Is Analyzed by National Association of Manufacturers

Pending in the United States Senate is S. 702, entitled "a bill to mobilize the scientific and technical resources of the nation, to establish an Office of Scientific and Technical Mobilization, and for other purposes." Hearings on it are being held before a Subcommittee on Technological Mobilization, specially formed within the Military Affairs Committee. Senator Harley M. Kilgore (Democrat, W. Va.) is chairman of the Subcommittee. A companion bill (H. R. 2100) has been introduced in the House by Representative Wright Patman (Democrat, Texas), and it has been referred to the Committee on Patents.

Analysis of S. 702 reveals that it presents a comprehensive plan for the most ambitious project to socialize industrial research and technical resources that has ever been proposed in the United States Congress.

The bill is based on the assumption that there is now an "absence of an effective Federal organization to promote and coordinate, in the national interest, scientific and technical developments," and that there must be Federal control and coordination of the scientific and technical facilities, personnel, and resources of the United States "for the effective prosecution of the war and for peacetime progress and prosperity" [Section 1].

Twelve purposes to be accomplished are set forth, among which are complete government direction, planning, and control of

(*a*) what are described as "scientific and technical facilities" which include every form of property either used or intended for scientific or technical purposes, including patents, inventions, processes, methods, designs, specifications, and all "know how" used or intended to be used for scientific and technical purposes either in research or in supplying war or civilian goods or services [Section 2 (*a*)];

(*b*) "scientific and technical personnel," including all persons, except physicians and dentists, who have completed college or university studies in any branch of science or have had not less than six months' training or employment in a technical vocation [Section 2 (*b*)].

Whenever the word "agency" or "establishment" is used it means not only Federal or State agencies but private firms or corporations and schools or colleges [Section 2 (*c*)].

The act is to be executed through what is termed the "Office of Scientific and Technical Mobilization" which is directed by a salaried Administrator appointed by the President and serving at pleasure, who appoints such officers and employees as he deems necessary within a preliminary appropriation of $200,000,000 and a revolving fund from properties under his control [Sections 3 (*a*) and 9 (*a*)]. He has at his service a "Board" and a "Committee" who perform such duties as he determines [Section 3 (*c*), (*d*), (*e*)].

An Administrative Dictator

This Administrator is given enormous power to make the act function, including the authority

(*a*) to take and keep a census of scientific and technical facilities and personnel hitherto defined, to formulate projects and programs for their use and development, to train the personnel, and to appraise the relation of scientific and technical developments to the national welfare; also to solicit private support to these ends [Section 4 (*a*) to (*e*)];

(*b*) to foster international cooperation and to arrange the reciprocal exchange of scientific information and personnel [Section 4 (*g*)];

(*c*) to review the specifications, standards, and designs of military and civilian products, also the methods of production and supply [Section 4 (*i*)];

(*d*) to finance in any way the purchase of any kind of property used or intended for scientific purposes, and to make contracts in the execution of his powers [Section 4 (*j*)].

Power Over Patents

The bill provides for vesting in the Office exclusive rights in inventions which have heretofore resulted or shall hereafter result from research or inventions to which the government has contributed since May 27, 1941, or shall hereafter contribute, "any money, credit, physical facilities, or personnel" [Section 7 (*a*)]. This is directly opposite to the Constitutional provision for granting to *inventors* "the exclusive right to their . . . discoveries."

By not limiting the inventions to be taken to those having "public use" interest, inventions are included in which the government, as such, could have no possible interest and with respect to which the government would not properly be exercising any right of eminent domain. The provision made for compensation for such taking is unsatisfactory [Section 7 (*d*)].

The Office would be provided with means by which it may acquire complete information regarding projects and developments under way within industry as well as among independent inventors [Section 1 (4), (6); Section 4 (*a*), (*b*); Section 8 (*a*); and Section 10]. It could then destroy the fruit of the labors of those from whom the information was acquired by having the government itself develop or turn the project over to someone else to develop, thereby vesting the completed invention in the Office [Sections 1 (6) and 4 (*b*)]. No redress would be available to the one who originally furnished the data on which the invention was developed.

In vesting exclusive patent rights for the present as well as the future in the Office, the government would be put in a position of necessarily entering into extensive interference and infringement litigation with industry and with individual inventors involving their conflicting interests in the respective inventions.

This provision for the vesting of exclusive rights in the Office ignores the *incentive* given to inventors by the Constitution to encourage invention, and also ignores the *incentive* given to speculative capital and industry to develop new enterprises which is now provided by the grant of exclusive rights in inventions for a limited time.

Applies to War and Peace

The Administrator is given special powers in (*a*) war and (*b*) peace:

(*a*) During war to requisition the use of scientific or technical facilities, licenses, etc., and to determine just compensation for the same, subject to judicial review, with the right to sublicense requisitioned patent licenses. He is the investigator of the efficiency of war production or supply, recommends improvements necessary and desirable, and becomes the exclusive representative of private and public applicants for allocation and priority ratings of critical material and equipment in scientific and technical research and development [Section 5 (*a*), (1), (2), (*b*); Section 6 (*a*), (1), (2), (3), (*b*), (*c*)].

For the Administrator's benefit the Selective Service Act is amended so that when on his application the "Chairman of the War Manpower Commission" certifies that scientific or technical persons are "critical" to the war effort, the Administrator becomes the exclusive authority for the occupational deferment of such persons and may direct their training [Section 5 (*a*), (1), (2)]. This personnel is said to number 1,700,000.

* See also pp. 209–10, June, 1943, *Bulletin*.

(*b*) All the other described powers of the Administrator may be exercised in time of peace to the ends described. He may make any investment necessary to the effectuation of the purposes of the act or the performance of his functions [Sections 4 (*j*) and 9 (*b*)], and to this end may require the production of books, papers, and other documents deemed relevant or material. This power may be exercised through any official designated by him. The courts are to enforce such powers under the threat of contempt. The refusal to supply such information or the violation of any regulations which the Commission has the power to make is punishable by fine and imprisonment [Section 10].

Unprecedented Authority

It must be clear from the above provisions of the bill that it would concentrate in the hands of a single government official unprecedented authority over all the properties and personnel devoted to scientific and technical research, planning, and training, not only in government establishments but among individuals, firms, corporations, and other forms of private employment and operation [Section 8].

(*a*) It would compel the reorganization within the War and Navy departments of committees and personnel engaged under the direction of or in cooperation with the military departments of the government and make them in many respects subordinate to the Administrator. Such departments are mentioned in the bill only to advise the Administrator with respect to the necessity of maintaining secret information [Section 6 (*b*), (*c*)].

(*b*) It withdraws from the Alien Property Custodian the powers which he has and presently exercises over patents and inventions [Section 7 (*a*), (2), (*b*), (*c*), (*e*), (*f*)].

(*c*) The measure ignores the existing cooperation of the scientific and technical organizations of the United States now freely at the service of the government and cooperating with the War and Navy departments.

Schools, colleges, and universities engaged in pure research are brought under the control of the Administrator in training and direction to the extent he declares their personnel to be engaged in scientific and technical study, extending similar control to all private efforts of the same character whether individual or corporate [Section 2 (*b*); Section 4 (*i*), (*m*); Section 7 (*b*), (*c*); Section 8 (*a*)].

The effect of the measure is to authorize the complete socialization of all forms of property, plans, methods, technical information, and "know how" of all industries and all personnel devoted to scientific and technical effort. It would hopelessly confuse the relation of all various departments of the government devoted to the prosecution of the war by reorganization of their relations to one another and to the proposed Administrator. Finally it would create the most despotic authority given to a single officer, and by vague and indefinite phrases it would enormously expand the enormous power conveyed.

Attention, Readers: In the interest of your economic welfare and of free enterprise you should write to your senators and congressmen in protest of this bill.—R. C. Purdy

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and
BORIC ACID
99½-100% PURE

NITRATE OF POTASH
CAUSTIC SODA
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Stauffer
INDUSTRIAL CHEMICALS
SINCE 1885

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444 Lake Shore Drive, Chicago, Illinois 550 South Flower Street, Los Angeles, Cal.

NEW PRECISION INSTRUMENT FOR MEASURING GLOSS

The American Instrument Co., Silver Spring, Md., has announced the manufacture of a new precision instrument for measuring gloss called the Aminco-Scott Glossmeter.

The Glossmeter (goniophotometer) measures high, medium, and low gloss (from zero to 100%) of plane surfaces of materials over $2^1/_8$ by 3 in. in size, such as paint finishes, enamels, lacquers, metals, wood, paper, plastics, and glass. Results are given in terms of the I.C.I. Normal Observer and I.C.I. Illuminant C.

Specular, contrast, distinctness-of-image, and absence-of-bloom gloss (relative apparent reflectance), as well as many other optical properties of surfaces of all kinds, are measured with this instrument. It is especially useful for A.S.T.M. Method D523 for measuring specular gloss of paint finishes.

It also is used to measure (1) the hiding power of deposited finishes, (2) the cleansing power of soaps and detergents, (3) the relative apparent reflectance of plane surfaces for obtaining Munsell value, (4) index of refraction, (5) the resistance of surfaces to abrasion, (6) weathering, (7) wear, and (8) glare.

Illumination is adjustable from −30° to +70° from the normal. The receptor is adjustable from +30° to −70° from the normal. Angles may be read to 1 min. of arc. Measurements of relative apparent reflectance from zero to 100% (in steps of 0.01%) can be made. Measurements can be made rapidly, e.g., a complete gloss curve of a high-gloss sample can be obtained in approximately 30 min.

The instrument, which weighs approximately 55 lb., has sufficient sensitivity and wide range to measure relative apparent reflectance from high to flat gloss without the use of neutral filters, wedges, or similar devices which are difficult to reproduce or calibrate. It operates on 110 to 120 volts 60 cycles (controlled frequency) single-phase a.-c. and is unaffected by fluctuations in line voltage. It need not be operated in a darkened room. The only up-

In on a Prayer and a Wing—A True Statement of Success in all Human Endeavors

keep cost is for infrequent renewal of the lamp.

The Aminco-Scott Glossmeter consists essentially of four main components, namely, (1) a goniophotometer, (2) a reference plate and sample holder, (3) a control and measuring unit, and (4) a galvanometer. A standard glass reference plate is supplied.

A complete description and specimen curves of the instrument are given in Bulletin AJ2115, which is available from the manufacturer.

DI-MET RESINOID CHIPBREAKERS

A new Di-Met diamond abrasive chipbreaker of unique construction has been developed by the Felker Manufacturing Co., Torrance, Calif. The Di-Met resinoid rim containing the diamonds is bonded to a laminated linen core, rather than to a metal core. The linen laminations are interlaid with a resinous compound and baked under high pressure, forming a tough, rigid construction.

Di-Met Resinoid Chipbreaker

The new core has high strength, yet possesses a degree of elasticity which is an important advantage in cutting carbides. The elasticity acts as a cushion, absorbing shock and sudden impact, and reduces chipping of wheel rims. At the same time, this resiliency aids in obtaining a smoother, softer cutting action. Diamonds are closely graded for size, a feature which assures maximum effective cutting edges per inch and which produces a faster cutting wheel.

The new Di-Met Chipbreakers are made in 3, 4, and 6-in. diameters of $^1/_8$-in. rim thickness and are suitable for rapidly cutting chipbreaker grooves, shaping and form grinding of carbide tips. Similar blades of thinner construction are now available for cut-off operations on carbide inserts. Di-Met Resinoid Chipbreakers will not operate dry as they are specifically designed for use with a coolant; they preferably are flooded with water during cutting operations.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The American Society of Mechanical Engineers has scheduled the following meetings for 1943 and 1944:

Joint meeting with the Engineering Institute of Canada, Toronto, Canada, September 30 to October 1.

1943 Annual Meeting, Hotel Pennsylvania, New York, N. Y., November 29 to December 3.

1944 Spring Meeting, Birmingham, Ala., April 3 to 5.

1944 Semiannual Meeting, Pittsburgh, Pa., June 19 to 22.

ADDITIONS TO SOCIETY STANDING COMMITTEES AND APPOINTED REPRESENTATIVES FOR 1943–1944*

Standing Committees

Committee on Classification and Nomenclature

M. F. BEECHER, *Chairman:* Norton Co., Worcester, Mass. (with the Chairman of the Classification and Nomenclature Committee of each Division)

Appointed Representatives

American Foundrymen's Association

H. RIES: 401 Thurston Ave., Ithaca, N. Y. (in addition to L. C. HEWITT)

American Society for Testing Materials

Committee C–4 on Clay Pipe: C. M. DODD, Dept. of Ceramic Engineering, Iowa State College, Ames, Iowa.

* For first list, see June, 1943, *Bulletin*, pp. 195–97.

WHITE WARES DIVISION COMMITTEE ON STEATITE HIGH 'K' FACTOR BODIES

This group is planning a symposium to be held at the Autumn Meeting of the White Wares Division, the program for which is being arranged by "Mike" Lambe, Dept. of Ceramic Engineering, Univ. of North Carolina, Raleigh, N. C.

LT. GLENN HOWATT, *Chairman*, General Ceramics Co., Keasbey, N. J.
M. D. RIGTERINK, Bell Telephone Laboratories, New York, N. Y.
ROLLAND ROUP, Globe-Union, Inc., Milwaukee, Wis.
FRED POTTER, Isolantite, Inc., Belleville, N. J.
HANS THURNAUER, American Lava Corp., Chattanooga, Tenn.
R. L. STONE, Dept. of Ceramic Engineering, Univ. of North Carolina, Raleigh, N. C.
A. M. HOSSENLOPP, Henry L. Crowley Co., West Orange, N. J.
J. GLEASON, General Ceramics Co., Keasbey, N. J.
E. H. FRITZ, Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.
F. P. HALL, Onondaga Pottery Co., Syracuse, N. Y.
LT. COL. W. R. SANSFORD, A.N.E.P.A., Pentagon Bldg., Washington, D. C.
LESLIE BROWN, Lenox, Inc., Trenton, N. J.
N. SCHNYDER, National Porcelain Co., Trenton, N. J.

WHITE WARES DIVISION COMMITTEE ON CLASSIFICATION AND NOMENCLATURE

A. S. WATTS, *Chairman*, Ohio State University, Columbus, Ohio.
J. R. BEAM, (Sanitary Ware): Universal Sanitary Mfg. Co., New Castle, Pa.
RALSTON RUSSELL, JR., (Electrical Porcelain): Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
HARRY THIEMECKE, (Semivitreous Dinnerware): Homer Laughlin China Co., Newell, W. Va.
E. K. KOOS (Vitreous Dinnerware): Sterling China Co., East Liverpool, Ohio.

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(2) In research for improving quality aad lowering costs.
(3) In collaboration with fellow ceramists.

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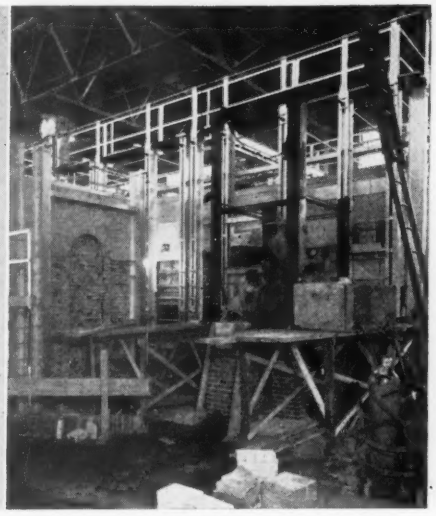

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Electro Refractories & Alloys Corp.
Felker Mfg. Co.
The Hommel, O., Co., Inc.
Norton Co. (*Alundum-Crystolon*)

Abrasive Wheels: (Diamond impregnated for cutting off brittle materials)
Felker Mfg. Co.

Air Conditioning Systems
Frazier-Simplex, Inc.

Aloxite (Refractory Products)
Carborundum Co.

Alumina (Hydrate and Calcined)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Alumina (Fused) Brick and Tile
Electro Refractories & Alloys Corp.
The Vitro Mfg. Co.

Aluminum Oxide (Calcine)
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Aluminum Oxide (Fused)
Carborundum Co.
Electro Refractories & Alloys Corp.
Foote Mineral Co.
Harshaw Chemical Co.
Norton Co.
The Vitro Mfg. Co.

Alundum (Refractory Products)
Norton Co.

Ammonium Bicarbonate
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Solvay Sales Corp.

Ammonium Bifluoride
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Ammonium Carbonate
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Antimony Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Antimony Sulphide
Foote Mineral Co.
The Hommel, O., Co., Inc.

Arches (Interlocking, Suspending, and Circular)
Frazier-Simplex, Inc.

Arsenic
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Automatic Brick Car Loaders
Lancaster Iron Works, Inc.

Ball Mills
The Hommel, O., Co., Inc.
McDanel Refractory Porcelain Co.
The Vitro Mfg. Co.

Ball Mills (Laboratory Type)
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Barium Carbonate
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Basic Oxides
Porcelain Enamel and Mfg. Co.

Batch Systems
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Batts
Carborundum Co. (*"Carbofrax Aloxite"*)
Electro Refractories & Alloys Corp.
Norton Co. (*Alundum-Crystolon*)

Bentonite
Hammill & Gillespie, Inc.

Beryl
Foote Mineral Co.

Bichromate of Soda
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Bitstone
Potters Supply Co.

Blades: (Diamond impregnated for cutting glass, tile, quartz, ceramics, Vitreous Products)
Felker Mfg. Co.

Blocks (Refractory)
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
The Vitro Mfg. Co.

Body Stains
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

Bone Ash
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Borax
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Borax Glass
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Boric Acid (Anhydrous)
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Boric Acid (Crystal, Granular, or Powder)
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Boron Carbide
Norton Co.

Brick Machines (also Barrows, Molds)
Lancaster Iron Works, Inc.

Brick (Refractory)
Carborundum Co. (*"Carbofrax Aloxite"*)
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
The Vitro Mfg. Co.

Cadmium Sulphide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Carbofrax (Refractory Products)
Carborundum Co.

Carbonates (Barium, Lead)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Castings
Lancaster Iron Works, Inc.

Caustic Potash
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Solvay Sales Corp.

Caustic Soda
Du Pont de Nemours, E .I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Cements
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Pennsylvania Salt Mfg. Co.

Ceramic Chemicals
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co
The Vitro Mfg. Co.

Cerium Oxide
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Chromite (Natural Chromate of Iron)
Foote Mineral Co.

Chromium Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Ball)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Potters Supply Co.
Spinks, H. C., Clay Co.
The Vitro Mfg. Co.

Clay (Bentonite)
Foote Mineral Co.
Great Lakes Foundry Sand Co.

Clay (Block)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Clay (China)
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
The Vitro Mfg. Co.

Clay—Cleaners, Feeders
Lancaster Iron Works, Inc.

Clay (Electrical Porcelain)
Hammill & Gillespie, Inc.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Clay (Enamel)
Du Pont de Nemours, E. I., & Co., Inc. Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Spinks, H. C., Clay Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Clay (Fire)
Great Lakes Foundry Sand Co.
Maxson, Elwyn L.
Potters Supply Co.

Clay (German Vallendar)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemical Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Micronized)
Porcelain Enamel and Mfg. Co.

Victory's ···— Magic Wand?

When the war is won, and victory is reckoned in terms of its contributors, save a pat of praise for a slender shank of steel—the rock drill.

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THIS GLASS CAN TAKE IT—HOT OR COLD

Ceramists are keeping their ears tuned these days for information on the possibilities of lithium carbonate. Lithium is in the alkali metal family which includes sodium, potassium, and rubidium. Sodium and potassium are, of course, powerful fluxes for glass and ceramic glazes and both have long been used. But lithium has all their advantages and a few more of its own. Lithium greatly reduces the melting point of glass and glazes. Lithium glasses and glazes have a very low coefficient of expansion thus thermal shock produces little internal stress or likelihood of breaking. These are by no means all the advantages gained by using lithium. Follow this column for additional information or write to us for comprehensive data on lithium.

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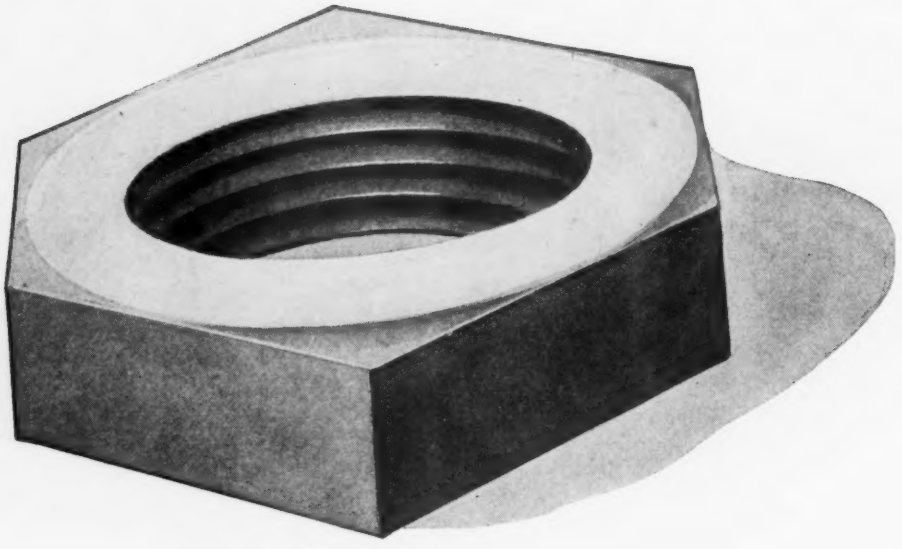
Tough nut to turn?



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* *"The Porcelain Enamel & Mfg. Co., Baltimore, Maryland; Chicago Vitreous Enamel Product Co., Cicero, Illinois; Ingram-Richardson Mfg. Co. of Indiana, Inc., Frankfort, Indiana, and American Porcelain Enamel Co., Muskegon, Michigan are licensed under U. S. Patents No. 1,848,567 and 1,944,938 held by the Titanium Alloy Manufacturing Company, and other patents pending, for the manufacture of zircon type enamel frits."*

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Spinks, H. C., Clay Co.

Clay (Potters)
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Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Clay (Process Equipment)
Lancaster Iron Works, Inc.
National Engineering Co.

Clay (Sagger)
Great Lakes Foundry Sand Co.
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Maxson, Elwyn L.
Potters Supply Co.
Spinks, H. C., Clay Co.

Clay-Slip (Albany)
Hammill & Gillespie, Inc.

Clay (Wad)
Kentucky Clay Mining Co.
Potters Supply Co.
Spinks, H. C., Clay Co.

Clay (Wall Tile)
Hammill & Gillespie, Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Cleaners
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.

Cleaners, Chemical
Harshaw Chemical Co.
Pennsylvania Salt Mfg. Co.

Clocks (Gauge Board)
The Hommel, O., Co., Inc.

CO_2 Recorders
Leeds & Northrup Co.

Cobalt Oxide
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Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cobalt Sulphate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Colors
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The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Combustion Control
Leeds & Northrup Co.

Combustion Meters (CO_2 Recorders)
Leeds & Northrup Co.

Cone Plaques
Industrial Ceramic Products, Inc.

Cones
The Edward Orton Jr., Ceramic Foundation

Controllers—Automatic Tank Pressure
Leeds & Northrup Co.

Conveying Equipment
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Lancaster Iron Works, Inc.
National Engineering Co.

Copper Oxide
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Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Corhart
Corhart Refractories Co.

Cornwall Stone (Imported)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.

Crucibles (Filter, Melting, Ignition)
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Norton Co.
Potters Supply Co.

Crushers (Clay)
Lancaster Iron Works, Inc.

Cryolite (see Kryolith)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Frazier-Simplex, Inc.

Cutters (Bar)
Industrial Ceramic Products, Inc.

Cutters: Diamond impregnated wheel type
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Decorating Supplies
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Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Disintegrators
Lancaster Iron Works, Inc.
National Engineering Co.

Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Drying Machinery
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
Proctor & Schwartz, Inc.

Electrocast Refractories
Corhart Refractories Co.

Enamelers' Borax
Porcelain Enamel and Mfg. Co.

Enameling Equipment (Complete)
Frazier-Simplex, Inc.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
The Hommel, O., Co., Inc.
Lancaster Iron Works, Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.

Enameling Muffles
Carborundum Co. (*Carbofrax*)
Frazier-Simplex, Inc.
Norton Co. (*Alundum*)

Enameling (Practical Service)
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Enamels
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Enamel Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Enamels (Porcelain)
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Equipment (Porcelain Enameling)
The Hommel, O., Co., Inc.

Feldspar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Filter Fabrics
Metakloth Company

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Great Lakes Foundry Sand Co.
Spinks, H. C., Clay Co.

Flint
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Great Lakes Foundry Sand Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Porcelain Enamel and Mfg. Co.

Flint Pebbles
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